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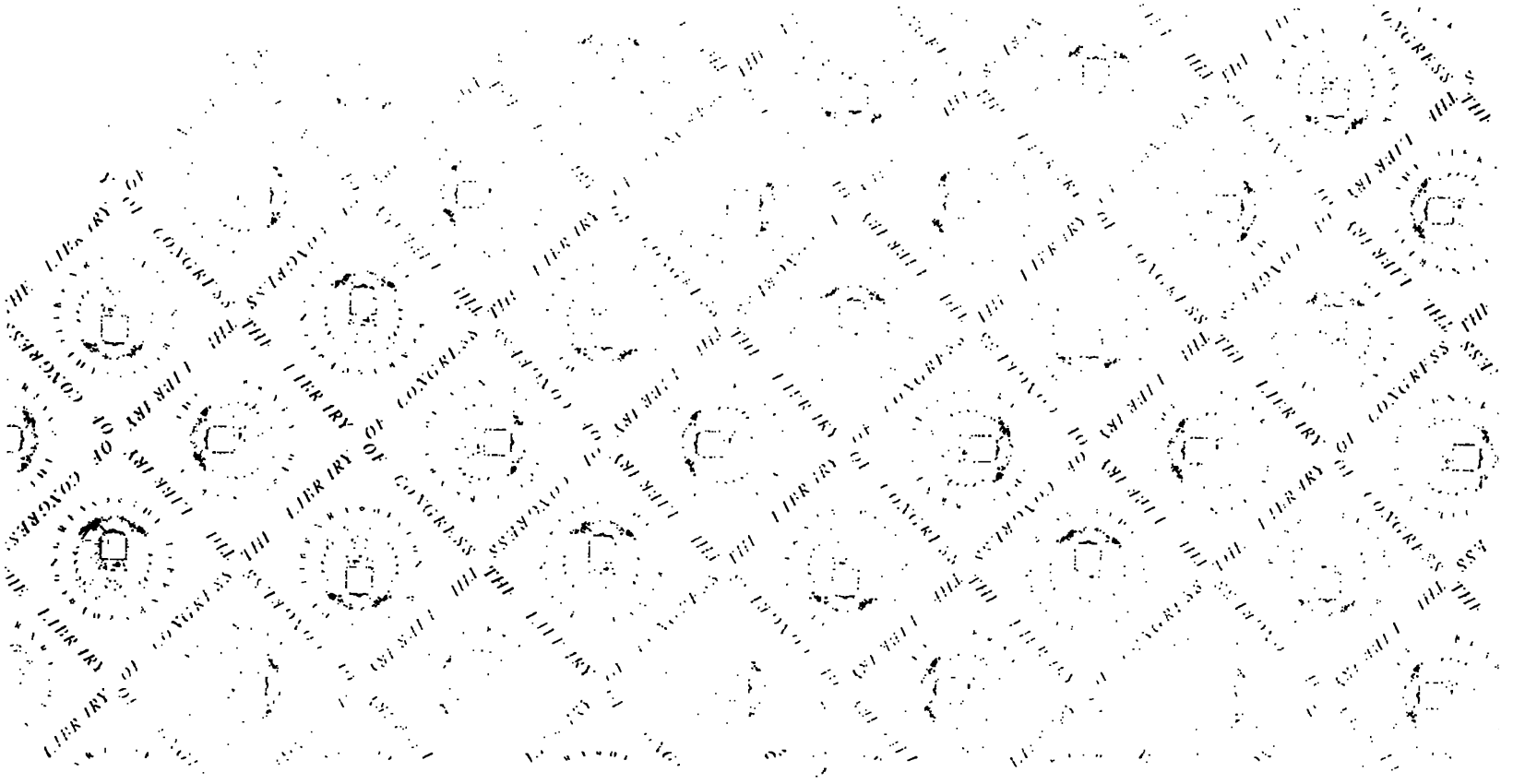
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THE

:ENTIFIC MONTHLY

AN ILLUSTRATED MAGAZINE

DEVOTED TO THE

ATURAL SCIENCES.

E. H. FITCH,
EDITOR AND PROPRIETOR.

VOLUME I.

TOLEDO, OHIO:
TOLEDO COMMERCIAL COMPANY, PRINTERS.
1876.

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...e Scientific Monthly.

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NO. 1.

The Monthly.

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ıe Devoted to the Natural Sciences.

H. FITCH, Editor and Proprietor.

TOLEDO, OHIO.

OCTOBER, 1875.——

The Scientific Monthly.

VOL. I. NO. 1.

PRICE, $3.00 A YEAR IN ADVANCE; OR, 45 CENTS A NUMBER.

All communications, of whatever nature, in regard to the Magazine, should be addressed to E. H. FITCH, Editor and Proprietor, TOLEDO, O.

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On account of an unavoidable accident we were compelled to destroy the entire edition of our Magazine just as it was ready for the binder, and commence printing anew. Therefore in order to appear at the appointed time, the first of October, we were obliged to reduce the size and leave out all illustrations. We hope our readers will excuse this unforeseen set-back, and we will make amends next month, appearing of the full size, with leaded type and illustrated.

THE SCIENTIFIC MONTHLY.

OCTOBER, 1875.

INTRODUCTION.

more fascinating and elevating in its character than that of the
ces. Here are found the most varied and graceful forms, the most
changing colors, the most delicate perfumes, and sweetest sounds.
beautiful in the world about us, can only be known in perfection
of nature."

pursue this varied and inexhaustible field without being convinc-
and benign Head and Creator, who controls and protects the whole
ed with awe and love for One who is at once so powerful and wise.
sing interest in Scientific investigation manifest in the west, seem-
field for some medium, and to fill that place, to afford some vehicle
n, and to promote the love of this study, and for the diffusion of
owledge among us, the SCIENTIFIC MONTHLY was started.

in a small and modest form we hope to increase the size and the
contents as we grow in age. We only hope that a generous and
iblic will sustain us in our efforts. We will endeavor to make the
ONTHLY a reliable and entertaining magazine of Natural Science.
ill have complete control of the contents and so be enabled to ex-
ant care to keep it free from all that is in any way objectionable.
s will be freely open for all well written articles on scientific sub-
candid setting forth of opinions and views on Natural Science.
s sent to the editor will be carefully preserved, and returned to
or if desired.

aries of Scientific Societies are respectfully solicited to forward to
soon after the meetings of their respective Associations as con-
reports of the proceedings and synopsis of essays and addresses
hem.

FIRST IMPRESSIONS OF THE BIRD-FAUNA OF CALIFORNIA, AND GENERAL REMARKS ON WESTERN ORNITHOLOGY.

BY ROBERT RIDGWAY.

PREFACE.

After several years spent in close study of the birds of his own neighborhood, and in obtaining a meagre knowledge of the birds of other portions of the country, through the medium of the few books bearing upon the subject then accessible, the opportunity was soon to be afforded the writer of becoming acquainted with the birds of California and other portions of the "Far West." This consumation of his fondest dreams was looked forward to with eager anticipations; and how these anticipations were realized, it is, in part, the purpose of this paper to relate.

GEOGRAPHICAL DISTRIBUTION.

All the way from Panama to San Francisco, several species of pelagic birds which we had not seen before had been following our steamer, the Sooty Albatross and white headed Gull being daily companions; but the only land-bird which came near was a solitary individual of the common Mourning Dove (*Zenaidura Carolinensis*), which circled round the vessel for an hour or more, but hesitated to alight, and finally disappeared, though no land was in view. This was off the coast of Mexico, considerably below Cape St. Lucas. We finally arrived at San Francisco, where we certainly expected to see strange birds immediately upon landing, but were disappointed; for when we listened, and looked about, only the familiar song of a caged Canary was heard, while the colonies of Cliff Swallows and Purple Martins, which swarmed about old buildings on certain streets were the only wild birds to be seen. So after several days of similar experience, we turned our attention to observing strange people, and watched with interest the fantastic-looking Chinamen, and gazed with wonder at the "Kanakas," Mexicans and native Californians who now and then appeared among the throng. After thus sojourning for about a week in San Francisco, we took a steamboat for Sacramento, where was to be our first chance of visiting the country, and commencing active operations in the study of the native birds. A suitable spot of observation was taken possession of on the hurricane-deck, from which a full view of the river on each side, as well as in front, could be had; but our vigilance was rewarded only by the sight of the common Kingfisher, perched upon an overhanging willow, an occasional "Schytepoke" (*Butorides virescens*) as he flew, with a harsh squawk, and characteristic accompaniments, at our approach; or of several already well known species of water-birds which swam contentedly near the margin of the river, or slyly escaped into the tules along the shore. We had been over a week in California, and not a single peculiarly Western bird seen yet! But arrived at Sacramento, we found an immediate change; for, in walking through the streets our attention was attracted by a fine Canary-like song among the shade trees, and in looking up into their leafy tops we discovered a crimson headed

called by the inhabitants the "Red-head Linnet," and which we after- to be the Crimson-fronted Finch, House Finch, or Burion (*Carpo- frontalis*) of the books—a species which we shall ever remember as our acquaintance among the Californian birds. Arrived at camp, just outskirts of the city, we were immediately introduced to many other and each day added to our circle of new-found friends. To many who have never been in California, it may perhaps not be known that in of that country the seasons are the *wet* and the *dry*; and that during six months of the year, including the whole of summer and portion of spring and fall, no rain whatever falls, while dur- half of the year there is almost constant precipitation. This is the case with the Sacramento Valley, where during the month of our cloud was to be seen in the sky, which, though at first beautiful from se blueness, soon became tiresome from its monotony. The sun was , too, the temperature sometimes showing as much as 110° in the shade he middle of the day. As a consequence of this intense heat and con- drought, it was only along the borders of the running streams and in ls watered by artificial irrigation that vegetation thrived, the open eing hot, dry and brown, the ground baked to a crust or ground to im- powder, the leaves of the scattered oaks burnt to a russet hue and the orched to dingy yellow. But where nourished by moisture, vegetation with a luxuriance bordering upon rankness, so that there was much the ntrast between the two classes of localities as that between the winter mer aspect of our Eastern country—and much the same appearance, the ance being much closer to the semi-prairie country of the Mississippi than the Atlantic coast. The effect of the absence or presence of ver- on the distribution of the birds was very marked; for in the arid locali- rce half a dozen species could be met with during an entire day's search, stroll among the groves,copses, and cultivated fields was likely to bring y to view. Our investigations were accordingly confined chiefly to the cality, and the situation of our camp enabled us to do so to advantage; g just outside the city limits, there was collecting ground of any nature le, on every hand, at convenient distance. Every day, excepting Sun- as spent in the study of the bird-life of the neighborhood; which, after a month of diligent investigation, resulted in the discovery of fifty-one , scarcely half the number to be found in a locality of corresponding lat- the Mississippi Valley. But the most unsatisfactory feature of this was, that of this number there were only nineteen which we had not pre- known in the East! *

etter enable our readers to see the relative proportion of the species we t seen before, and those found also in the Eastern States, the following presented:

'ST OF BIRDS BREEDING AT SACRAMENTO, (JUNE, 1867.)

FOUND IN THE EAST.	NOT FOUND IN THE EAST.
ewick's Wren.	Least Vireo,
ellow Warbler,	House Finch,
aryland Yellow-throat,	Brewer's Sparrow,
ellow-breasted Chat,	Lazuli Bunting,

ern Illinois, where in the Wabash Valley, we have found upwards of one hundred ifty species, breeding!

5 Barn Swallow,
6 Cliff "
7 Purple Martin,
8 Warbling Vireo,
9 Loggerhead Shrike,
10 Goldfinch,
11 Yellow-winged Sparrow,
12 Song Sparrow,
13 Chipping Sparrow,
14 Blue Grosbeak,
15 Red-wing Blackbird,
16 Traill's Flycatcher,
17 Yellow-bill Cuckoo,
18 Belted Kingfisher.
19 Long-ear Owl,
20 Sparrow Hawk,
21 Mourning Dove,
22 Killdeer Plover,
23 *Great Blue Heron,
24 Egret Heron,
25 Green "
26 Black-crowned Night Heron,
27 Florida Gallinule,
28 Coot,
29 Mallard,
30 Red-head, (?)
31 Forster's Tern,
32 Black "

Black-headed Grosbeak,
Oregon Ground Robin,
Red-and-white-winged Blackbird.
*Yellow-headed Blackbird,
Western Meadow Lark,
Bullock's Oriole,
Arkansas Kingbird,
Black Pewee,
Richardson's Pewee,
Anna Humming Bird,
Black-chinned Humming Bird,
Red-shafted Flicker,
†Burrowing Owl,
‡Red-breasted Teal,
*Lark Sparrow.

Among the species not found in the East are several which, however, correspond so closely with representative Eastern forms as to replace them either in voice, habits, or appearance. They are the following:

1	Least Vireo,	*representing*	Bell's Vireo.
2	Brewer's Sparrow,	"	Field Sparrow.
3	Black-headed Grosbeak,	"	Rose-breasted Grosbeak.
4	Lazuli Bunting,	"	Indigo Bunting,
5	Oregon Ground Robin,	"	Chewink Ground Robin.
6	Western Meadow Lark,	"	Eastern Meadow Lark.
7	Bullock's Oriole,	"	Baltimore Oriole.
8	Arkansas King-bird,	"	Common King-bird.
9	Black Pewee,	"	Common Pewee.
10	Richardson's Pewee,	"	Wood Pewee.
11	Black-chinned Hummer,	"	Ruby-throated Hummer.
12	Red-shafted Flicker,	"	Yellow-shafted Flicker.
13	Red-breasted Teal,	"	Blue-winged Teal.

*These species occur abundantly throughout the Mississippi valley, and have been found in Florida.
†This species is found in Florida, and has been captured also in Massachusetts and New York.
‡Occurs in Louisiana.

remain but six types not represented in the East by kindred

'n the preceding list, the Least Vireo, Red-and white-winged Pewee and Anna Humming Bird were not met with after o; but all the others were encountered at one point or another so the species hereafter mentioned will be only the accessions from time to time during our progress eastward; and these according to the locality—in each case arranging the wes- those comm.on to both sides of the continent in separate

City on the 4th of July, for the Sierra Nevada, and in rip across the plain, the following species were seen for the

Species.	*Eastern Also.*
Magpie,	1 †Black-capChickadee,(v. *occidentalis*)
Flycatcher,	2 House Wren, (var. *parkmanni.*)
	3 Horned Lark, (var. *chrysolæma.*)
	4 †Barn Owl,
	5 †Mottled Owl,
	6 †Red-shouldered Hawk, (var.*elegans*)
	7 Turkey Vulture.

facts of relationship develop themselves in the study of these repre- hey may have been at one time, they are *now valid species*, in ıat term, for we have not included in the enumeration the slight of Eastern forms. What is very striking, is that in those species ıe voice is most strikingly different; while those differing most in notes are nearly or quite alike; comparitively few differ in both re- nalogous.

peculiarities the Western representatives of Eastern species may be

WIDELY IN NOTES BUT HARDLY, IF AT ALL, IN PLUMAGE.

Species.	*Eastern Species.*
Lark.	Eastern Meadow Lark.
ewee.	Wood Pewee.

FERING IN COLORS OR MARKINGS, BUT NOT IN NOTES.

	Carolina Chickadee.
	Brown-headed Nuthatch.
	Tufted Titmouse.
	Scarlet Tanager.
	Common Snowbird.
Grosbeak,	Rose-breasted Grosbeak.
	Indigo Bunting.
	Rusty Blackbird.
	Common Pewee.
	Yellow-shafted Flicker.

DIFFERING IN BOTH PLUMAGE AND VOICE.

	Common Bluebird.
Warbler,	Yellow-rump Warbler.
Warbler,	Mourning Warbler.
	Common Chewink.
	Baltimore Oriole.
	Whip-poor-will.
	Red-headed Woodpecker.

to the Eastward.

until the Gt. Salt Lake Valley was reached, and then var. *septentrio-*

Our arrival at the foot-hills of the Sierra Nevada, almost universally forest-covered, caused the following accessions to be made to our list:

*1 Least Titmouse,
*2 Lawrence's Goldfinch,
*3 Brown Towhee,
4 California Jay,
*5 California Quail.
*1 Blue-gray Gnatcatcher,
2 Brown Creeper.

After leaving the foot-hills, whose woods were composed largely of deciduous trees, the deep, heavy forests of massive Coniferæ clothing continuously the main ranges, were entered, and there the following species first appeared:

1 California Bluebird,
2 Water Ouzel,
3 Townsend's Soltaire,
4 Audubon's Warbler,
5 Louisiana Tanager,
6 Oregon Snowbird,
7 Clarke's Nutcracker,
8 Steller's Jay, (var. *frontalis.*)
9 White-headed Woodpecker,
*10 Red-breasted Woodpecker,
11 Gambel's Sparrow, (var. *intermedia.*)
1 Olive-backed Thrush,(var.*ustulatus*)
2 Golden Eagle.

On the Eastern slope, clothed with similar forests, 'though of lighter timber, the following species were first observed; some, if not all, of them may occur on the Western slope, but we did not observe them until after passing the summit (Donner Lake Pass):

1 Mountain Chickadee,
2 Pigmy Nuthatch,
3 McGillivray's Warbler,
4 Cassin's Purple Finch,
*5 Thick-billed Sparrow,
6 Hammond's Flycatcher,
7 Wright's Flycatcher,
8 Calliope Humming Bird,
9 Williamson's Woodpecker,
10 Dusky Grouse.
White-bellied Nuthatch,(var. *aculeata.*)
Ruby-crowned Kinglet,
Orange-crowned Warbler,
Black-capped Green Warbler,
Pine Goldfinch,
Lincoln's Sparrow,
Olive-sided Flycatcher,
Yellow-bellied Flycatcher,(var.*difficilis*)

Of the species in the preceding lists, not already so noted, only the California Jay, California Bluebird, Steller's Jay, and White-headed Woodpecker, were not seen again after leaving the pine woods of the Eastern slope of the Sierra Nevada; all the others recurred from time to time, but only in isolated places, where some one of the higher of the interior ranges reached a sufficient elevation to secure the chief part of the precipitation of the region, and consequent woods of greater or less extent, corresponding in general character with those on the Sierras; but then these merely represent a portion of the general Western fauna limited in its range to the coniferous forests, occurring wherever these occur, but necessarily of interrupted range within the Great Basin, where the narrow strips of pine woods, at rare and distant intervals, may be compared to islands in the sea.

*Not observed farther to the Eastward.

preceding lists bring us to the verge of the great interior basin, whose is so strikingly different from that of all other portions of the country, t may not be amiss to dwell at some length upon its characteristic features dealing with its bird life.

traveler is supposed to have come from California, leaving first the Sacnto river with its moderately rich vegetation and cultivated fields, thence the rolling, parched, but grassy and semi-wooded plains and then over sierra Nevada. The latter portion of his trip has been through a conifer-forest for near a hundred miles, this forest is one of the heaviest on 'n the dense growth, massiveness and altitude of its timber; he has de- the Eastern slope, through a continuation of this forest, and reaching he finds that the latter are very steep, and that they end very ab- another conspicuous fact is that the forest continues down to their out that it ceases very abruptly as soon as the valley level is reached. ne strangest thing of all is the view that unfolds before him. At the first e all vegetation seems to have ceased with the forest in whose edge he ls, for, looking to the Eastward are seen parallel mountain ranges, alter- y succeeding each other with the most monotonous regularity; the whole is one boundless extent of sombre gray or brown, relieved only by patch- various bright colors here and there among the desert mountains, where olcanic rocks show hues of red, blue, green and ochre, and various inter- ate tints. There is no other variety in the whole extent of vision; every- e the same dead grayish hue prevails, the dull uniformity of barren waste g unrelieved by any spots of verdure, except the narrow thread of green h intersects the valley and breaks, as it were, into a gorge in the mountain e on the opposite side, and marking the course of a river, where waters from the snow-fields of the Sierra, and after continuing the course point- ut, and breaking through gorges in one or two mountain ranges, finally ies into an inland lake which has no outlet, but is lost in the sand and al of a desert valley, the surplus water being rapidly evaporated by the in- e heat of the sun. Wherever the surface is not too sterile for even these ow, the "sage brush" plants predominate, and, by their unthrifty appear- and sickly color constitute a most miserable apology for vegetation.

his is the prevailing character of the great interior basin, but there are e types of localities which though restricted in extent tend to break some- t the general monotony. The first consists of the immediate vicinity of ing streams—the rivers of the valleys and the rivulets in the canons of the er ranges; the second, the scattered groves of Nut Pine and Western Ce- which scantily clothe some of the desert ranges, independent of the pres- of water; and the third, the alkaline flats, or the surface of the lower lev- of the valleys incrusted with alkaline salts. There are also lakes and ks," at the termini of the rivers, which partake in their nature of the char- ristics of the rivers themselves and of the alkaline flats.

mpared with the general extent of the Interior, the wooded portions are seen to be exceedingly limited in their extent; the cottonwoods and their ndant shrubbery in the river bottoms; the brushwood bordering the canon ms; the dry Pinon and Cedar groves on the slopes of the desert mountains, the Aspen groves and coniferous woods on a few of the higher ranges con ting the entire sylva of the region. The distribution of the fauna of this liar country, is strictly governed by the disposition of these localities, each ng its characteristic set of species. For the sake of convenience, then, we l arrange the species which were found breeding in the Great Basin under following heads:

I. *The birds of the sage brush.*

This includes by far the greater portion of the country, but the characteristics of the section are most highly developed in the valleys and on the *mesas* as well as the foot hills, and lower slope of the mountains.

II. *The birds of the meadow portions.*

This section comprises the grassy sward of the river bottoms, as well as the patches of "Rye Grass" in other moist localities.

III. *The species inhabiting rivers, lakes and sloughs.*

IV. *The species of the cottonwoods and attendant shrubbery in the riverbottoms.*

V. *The species of the brushwood along the streams of the fertile mountain canons and ravines.*

VI. *The open, elevated "parks."*

VII. *The species of the cedar pinon, and mahogony groves of the slopes of the mountains.*

VIII. *The species of the aspen groves at the heads of canons.*

IX. *Those of the higher coniferous woods.*

X. *The saxicoline avi-fauna.*

In these lists we shall give only the species characteristic of each locality.

I. THE SAGE BRUSH FAUNA.

Mountain Mocking Bird,
Bell's Sparrow, (var. *nevadensis.*)
Black-throated Sparrow,
Brewer's "
Lark "
Poor-will,
Burrowing Owl,
Sage-cock.
Horned Lark,
Night Hawk.

II. THE MEADOW FAUNA.

Western Meadow Lark,
Sharp-tailed Grouse.
Bay-winged Bunting,
Yellow-winged Bunting.
Savanna Sparrow,
Sand-hill Crane.

III. THE AQUATIC FAUNA.

Yellow-headed Blackbird,
Red-breasted Teal.
Western Grebe,
California "
" Gull,
Green Ibis, (*Western border.*)
Bronze " (*Eastern border.*)
Baird's Sandpiper.
Long-billed Marsh Wren,
Red-winged Blackbird,
Kill deer Plover,
Wilson's Phalarope,
Avocet,
Stilt,
Long-billed Curlew,
Spotted Sandpiper.
Solitary "
Great Blue Heron,
Egret Heron,
Common Night Heron,
Bittern,
Least Bittern,
Virginia Rail,
Carolina Rail,
Little Black Rail, (?)
Canada Goose,
Mallard,
Gadwall,
Pintail.

Shoveller.
Blue-winged Teal,
Green-winged Teal,
Bald-pate,
Wood Duck,
Ruddy Duck,
Royal Tern,
Forster's Tern,
Black Tern,
Double-crested Cormorant,
White Pelican.

F THN COTTONWOODS AND THICKETS OF THE RIVER VALLEYS.

House Wren,
Yellow Warbler,
Maryland Yellow-throat,
Yellow-breasted Chat,
White-bellied Swallow,
Warbling Vireo,
Common Goldfinch,
Common Kingbird,
Yellow-billed Cuckoo,
Sparrow Hawk,
Turkey Vulture.

FAUNA OF THE PARK AND CANON THICKETS.

mouse,
Warbler,

Song Sparrow,
Traill's Flycatcher.

ay,
Humming Bird.

VI. THE ELEVATED GARDEN-LIKE PARKS.

(*Western border.*)
N.
mer.

Lincoln's Sparrow,
White-crowned Sparrow,(*Eastern border.*)

HE CEDAR, PINON AND MAHOGANY GROVES.

Logger-head Shrike,
Chipping Sparrow.

Gray Warbler,
Vireo,
racker.

Robin,
l,
*Ruby-crowned Kinglet,
*Brown Creeper,
Long-billed Marsh Wren,
ouse,
House Wren,
adee.
*Winter Wren,
†White-bellied Nuthatch,

VIII. THE ASPEN GROVES AT THE HEADS OF CANONS (ABOVE THE PARKS.)

Red-naped Woodpecker,
Hammond's Flycatcher,
Robin,
Orange-crowned Warbler,
Purple Martin,
Downy Woodpecker, (var. *gairdneri.*)

IX. THE PINE REGION, OR HIGHER CONIFEROUS WOODS.

Water Ouzel,
Mountain Chickadee,
Pigmy Nuthatch,
Audubon's Warbler,
Cassin's Purple Finch.
Red-backed Snowbird, (*East'n port'n*)
Clarke's Nutcracker,
Long-crested Jay, (*East'n port'n.*)
Williamson's Woodpecker,
Dusky Grouse.
Ruby-crowned Kinglet,
White-bellied Nuthatch, (var. *aculeata.*)
Red-bellied Nuthatch,
Brown Creeper,
? White-winged Cross-bill.
Pine Goldfinch,
Olive-sided Flycatcher,
Yellow-bellied Flycatcher,
Ruffed Grouse, (var. *umbelloides.*)

X. THE SAXICOLINE AVI-FAUNA.

Rock Wren.
White-throated Wren,
Violet-green Swallow,
Say's Pewee,
White-throated Swift,
Prairie Falcon.
Barn Swallow,
Cliff Swallow,
Bank Swallow,
Rough winged Swallow,
Golden Eagle.

This arrangement of local avi-faunæ of the Great Basin is merely for the sake of convenience, since it is of course not to be supposed that the bounderies of the sections are in all instances distinctly defined. In cases where two well-marked sections directly join there is along their line of junction a blending or confusion of the sets of birds characteristic of each. It is also to be borne in mind that the foregoing classification applies to the nesting season alone, and that we give in each list the species which have their *centre of abundance* in that section, and not merely those which are strictly confined to such localities.

The species which we have mentioned are those common to the whole breadth of the Great Basin in the latitude of our explorations (40°-N.) and during our progress Eastward we continually added to the list by the observation or capture of stragglers, or frontier families, of species more abundant in the Rocky Mountains. These we shall classify by localities in regular order Eastward, as follows:

(1) TOYABE MOUNTAINS (NEAR AUSTIN.)

White-throated Swift.

(2) RUBY MOUNTAINS (EASTERN SLOPE.)

? Black-eared Tit,
Mountain Warbler,
Black-throated Gray Warbler,
Lead-colored Vireo,
White-winged Cross-bill,
Broad-tailed Humming Bird.

(3) SALT LAKE VALLEY, (NEAR SALT LAKE CITY.)

Snowy Plover,
Catbird,
Tawny Thrush,
Red-start, [*onalis.*)
Black-capped Chickadee, (var. *septentri-*
Bob-o-link,
Red-headed Woodpecker.

(4) WAHSATCH MOUNTAINS.

Goldfinch,
Snowbird,
Sparrow,
Jay.
*Olive-backed Thrush,
Hermit Thrush,
*Red-bellied Nuthatch,
*White-crowned Sparrow,
Downy Woodpecker,
Ruffed Grouse.

(5) KAMAS PRAIRIE.

Bartram's "Plover."

the fall migrations the following transient species were observed at

(1) WEST HUMBOLDT MOUNTAINS.

s Vireo,
crowned Sparrow,
Song Sparrow,
Ground Robin.
Solitary Vireo,
Passenger Pigeon,
?Yellow-shafted Flicker.

(2) EAST HUMBOLDT MOUNTAINS.

nd's Warbler,
n Warbler,
nd's Flycatcher,
Hummer.
Nashville Warbler,
Olive-backed Thrush.

(3) UPPER HUMBOLDT VALLEY.

ailed Grouse.
Cedar Wax-wing,
Sharp-shinned Hawk.

(4) THOUSAND SPRING VALLEY.

Saw-whet Owl.

the species already enumerated, several were found breeding only at alities, as follows:—At Pyramid Lake, on the rocky islands, the Bald d Duck Hawk; at the Soda Lake, in the Carson Desert, a species s taken for, and probably was, *Phœnopela nitens*, or the Shining Fly-

winter the disposition of the local avi-fauna is wholly changed, in con- of the moving of the bands to lower latitudes or lower altitudes, in r a climate suited to their organizations or the production of their ie summer sojourners retire southward; the valleys and sheltered e occupied by the flocks from the higher mountains while the latter led by the species arrived from the high North. No opportunity was for investigating the winter avi-fauna of the mountains higher than City, Nevada, where the Gray-headed Purple Finch (*Leucosticte litto-* s seen in large flocks. At Carson City, however, at the Eastern base erra Nevada an entire winter was spent in the study of the birds of ent valley, the result of which was that the following species were be winter residents, or visitants there:

cies are found Westward of the Salt Lake Basin during their *autumnal migra-* ut not during the breeding season.

White-throated Wren,
*Audubon's Warbler,
*Gambel's Sparrow, (var. *intermedia*)
*Oregon Snowbird,
Sage Sparrow,
*Slate-colored Sparrow,
Oregon Towhee,
Yellow-headed Blackbird,
Western Meadow Lark,
*Brewer's Blackbird,
Magpie,
†Stellar's Jay, (var. *frontalis*,)
Maximilian's Nutcracker,
†Common Nutcracker,
†White-headed Woodpecker,
†Williamson's "
Red-shafted Flicker,
Burrowing Owl,
Prairie Falcon,
Swainson's Hawk,
†Mountain Quail,
*Hutchins' Goose,
Western Grebe,
California "
*Ring-billed Gull.
*Titlark,
*Northern Shrike,
Loggerhead " (var. *excubitoroides*,)
*Lappland Longspur,
Horned Lark, (vars. †*alpestris*, †*leuco-*
*Tree Sparrow, [*læma* and *chrysolæma*)
Song Sparrow, (var. *heermanni*,)
Red-wing Blackbird,
Raven,
Common Crow,
Hairy Woodpecker, (var, *harrissi*,)
†Arctic Three-toed Woodpecker,
Great Horned Owl,
Long-eared Owl,
*Pigeon Hawk,
Sparrow "
Marsh "
Cooper's "
Rough-legged Hawk,
Red-tailed " (var. *calurus*,)
Golden Eagle,
Killdeer Plover,
Bittern,
Canada Goose,
Mallard Duck,
*Redhead "
Canvass-back Duck,
*Golden-eye "
*Butter-ball "
*Black-head "
*Ring-neck "
Ruddy "
Carolina Grebe.

NOTES.

With many well known Eastern Birds forming so large a proportion of the Western avi-fauna, it of course follows that their notes greet the ear quite as often as do songs not heard except in the Eastern country; but so great is the change produced by altitude upon the distribution of the birds, that in the valleys one can listen to a song which he cannot hear north of the "Carolinian Faunna" on the Atlantic coast, and after a few minute's walk can hear notes, to hear which he would have to travel to Maine or Canada; while other species are found wherever there is woodland of any kind. Of the latter class is the common Robin, which, in the West chooses as his favorite summer home, the elevated parks of the mountain districts, among the aspen groves, although he is not unfrequently seen in the valleys; and there he pipes his familiar melody in just the same notes that he does in the East. In the lower valleys the mournful cooing of the Common Dove, the loud, odd, varied whistling of the Yellow-breasted Chat and the meandering ditty of the Warbling Vireo, are other familiar voices. Along the river-side the complaining cries of the Kill-deer, the

*Not found in the valleys in Summer.
†Species which enter the valley only when severe and protracted storms on the mountains drive them from the pines in search of food.

peet-weet of the Spotted Sandpiper and the loud rattle of the Belted King- are heard throughout the day, and in the *tule* marshes the scolding sput- he Long-billed Marsh Wren, mingled with the musical notes of the Red Blackbird, the clatter of Coots and chatter of various species of Ducks. mountain canons the well-known chant of the Song-Sparrow, here a little is heard the soft, ethereal carol of the Olive-backed Thrush, and, higher ue pine-region, the rich, subtle warblings of the Ruby-crowned Kinglet, the of the Pine Goldfinch, the sweet song of Lincoln's Sparrow, and the whistling of the White-crowned Sparrow. But mingled with these well are many others which at once strike the ear as unfamiliar. The with the squawking and screaming of the Crested Jays and Nut- woodhouse's Jay screeches in a piercingly high key as he darts into a and over the pinon groves sweep flocks of restless Blue Nutcrackers milian's Jays, uttering querulous, piping notes, and reminding one of s of wild pigeons seen in the East. Instead of the noisy, wary Crow. ately, familiar Raven, whose hoarse croaking is heard on every hand. of chattering Magpies, displaying their elegant plumage and graceful they sport among the thickets. In the "sage-brush" of the valleys. ous Mountain Mocking Bird warbles sweetly, the Black-throated and arrows (*Amphispiza bilineata* and *A. nevadensis*) sing their sad, pen- , and now and then, from the meadow, is wafted on the breeze, that fin estern melodies, the song of the Western Meadow Lark—a loud, ringing ssessing the mellowness of the Baltimore's flute-like notes, and the metal- f the Wood Thrush's song, combined with a power peculiarly its own, and ly different from the weak, half timid, "*peek'—you can't see me*" of the species as to convey not the slightest suspicion of the near relation the singer. Among the rock-piles and in the recesses of the canon o kinds of Wrens dwell, one, the common Rock Wren, noticeable from iarity, the other, the White-throated Wren, remarkable for its powerful song. Besides these, in the secluded parts of the pine forest, one may rtunate as to hear the silvery enchanting song of the "invisible" Soli *lyiadestes townsendi*), and near him the rippling of the brook is for a drowned in the sudden outburst of song from the Dipper (*Cinclus us*).

are many other songs which play no inconspicuous part in the chorus oices which enliven the Western wilds. The merry little House Wren ave been mentioned, for he is found in all wooded places from the low- ys nearly to the limit of vegetation, and is always busy with his spright- ling song. There are many more which we have not now time nor space ion; so we will reserve them for another time.

NIAN INSTITUTE.
hington, D. C.
gust 26, 1875.

SUPPOSED AGENCY OF ICE-FLOES IN THE CHAMPLAIN EPOCH.

BY PROFESSOR A. WINCHELL, SYRACUSE, N. Y.

I desire briefly to call attention to some phenomena of Drift deposits, occurring in Michigan, which do not seem capable of explanation by an appeal to the commonly recognized Drift agencies. I refer to the existence of large masses of limestone imbedded in those semi-stratified portions of the Drift which are generally regarded as bearing the marks of fluvial or torrential action.

My particular attention was arrested by some of these phenomena in 1859. In 1865 I published a note on the subject.*

During the ten years which have since intervened, my observations have been considerably extended, and the hypothetical explanations heretofore offered seem quite as plausible as at first.

In the article to which I have alluded, I cited a number of instances, out of multitudes which had fallen under my observation, of the occurrence of large tabular masses of Corniferous limestone imbedded in arenaceous Drift, throughout a belt overlying the outcrop of the Huron and Marshall groups, in Lenawee, Hillsdale, Jackson and Washtenaw counties. The age of the limestone was proven by the lists of fossils given; and the geological position of their places of occurrence was evidenced by outcrops of the Marshall sandstone in the near vicinity, or by its discovery in wells from 30 to 50 feet deep in the immediate neighborhood. Many of these masses had been extensively quarried for lime. Some had been exhausted and the "Modified Drift" was found underlying them to a depth of 20 to 50 feet. The masses were from 6 to 20 feet in length and breadth, and from 3 to 4 or more feet in thickness. They rested in sub-horizontal positions, but generally inclined in the direction of the hill-slope on which they lay. The nearest outcrops of the Corniferous limestone were 10 to 20 miles distant on the south and southeast. The next nearest were in the northern extremity of the Peninsula. A similar phenomenon was instanced as far west as Van Buren county, where the nearest Corniferous outcrops on the south were considerably more remote.

It was also stated that well-preserved fossils from the Hamilton group occur in great abundance, in such situations over the newer strata, as to lead to a similar inference, that they had undergone a northward transportation. Reference was made, moreover, to a similar northward transfer of friable fragments of the Marshall sandstone; and of abundant nodules of kidney iron ore from the Huron group of shales. I forbear repeating here any of the facts cited, and refer the reader to the earlier paper embracing them.

I have lately discovered some new instances of huge limestone masses, anomalously detached from the formation to which they belong; and have embraced references to localities, in a paper read before the American Association at Detroit. These are masses of Carboniferous limestone from 10 to 60 feet in length and often of unknown thickness, floating in the sands of Oceana county, apparently 100 or 200 feet above the bed rock. Some of these, I feel constrained to believe, must be genuine exposures of the formation, in place; but

*"Some Indications of a Northward Transportation of Drift Materials in the Lower Peninsula of Michigan."—*Amer. Jour. Sci. and Arts, Vol. XL., Nov.* 1865.

being worked out, or by their down-hill dip, far exceeding and disa
...th, the normal dip of the formation are demonstrably dissevered and
portions of it. For example, one region of exposures of this class in
of Claybanks, is within half a mile of the shore of Lake Michigan,
have a bluff 250 feet in height, and attaining, a few rods back, an el-
275 feet, serving as a station of the U. S. Lake Survey. The vicinity
around is elevated 250 to 300 feet above the lake. But the section of
exposed in the bluff upon the lake shore is wholly post-tertiary. It
intimately mingled sand and clay, confusedly stratified above, hori-
lower down, and followed downward by an increase of argil-
and pebbles, interrupted by a bed of boulders, beneath which
is a mass of boulder clay seen above a lake-border talus of ten feet.
the prevailing constitution of the drift of the Peninsula, there
...ll lower, a thick bed of fine, horizontally-stratified clay, with few
on a bottom-sheet of pebbles and boulders. The drift here is
n... less than 300 feet thick. Now it is possible that, 2,500 feet
bluff, the bed-rock should appear at the surface; but my experi-
strongly inclines me to believe that such is not the fact; and
numerous outcrops near the lake are mere detached masses.
then, in Michigan, in regions widely separated, the well-established
of extensive tabular masses of limestone floating in the midst of
sands, generally believed to have been moved and deposited by
which, obviously, could not have transported at the same
tables of rock. We have, in addition, in some parts of the
...at this action was sometimes exerted in a northerly di-
theory must attempt to account for these facts.
accepted doctrine of continental glaciation, recognizes a time
...cier underwent a rapid dissolution. The volume of water
to have been sufficient to produce a long-continued, torren-
moved and assorted whatever detritus existed in its path.
...e detrital material which must have originated from atmos-
and fluvial action over the preglacial surface, a vast volume of
have been originated during the prevalence of the glacier, and
its action. Most of this must have rested at or near the bottom
but probably no small portion had become incorporated with
intruded into its fissures, or deposited upon its back. The first gla-
the original projections of the ancient surface, which, with
of the glacier, must have been displaced to become ultimately
glacier debris. These and the materials derived from sub-glacial
have found their way, to some extent, into the *bottom crevasses*
any diminution in the steepness of the slope down which the glacier
still more when, as was often the case, the change of slope became,
northward declivity. These ordinary conditions of the continental
feebly represented in the steeper slopes and narrowed limits of
have resulted frequently in extensive disruptions of the
typified in the pyramids and seracs of the Alpine ice-streams. Such
of the lower beds—still more, occasional complete bouleversements
of the glacier, must have brought considerable earthy detritus to
face of the glacier. In the process of ages, as the ice may be sup-
e diminished, through evaporation, if not through thaw-
material, which never evaporated, must have accu-
a large extent. However we account for this fact, every one
human bodies or other objects, accidentally lost in the glaciers of

Mont Blanc, reappear at the surface after a series of years, at points thousands of feet below.

I infer, therefore, that the material moved by the diluvial waters may hav been afforded by some of the interior portions and even the surface of the gla cier, as well as by the subjacent rock-rubbish. I will only add that some por tions of the material in and upon the ice may have been let down *in situ* by slow disappearance of the glacier, without having been subjected to the assor ing action of the glacial torrents.*

This procees is impressively illustrated along the borders of the Mer Glace and other Alpine glaciers; and more instructively still in the buried cier stumps found in the gulches of the Sierra Nevada, and elsewhere in the Pacific States.

I know of no certain evidences, in Michigan, of a Champlain depressior such extent as to bring the surface of any portion of the State below the level. In a district so nearly horizontal, however, there must have been a riod, before the erosions of the modern drainage courses had begun, which the drainage was exceedingly obstructed and slow. The supply of w ter from the dissolving glacier was greater than could be discharged throug the forming outlets; and extensive areas must have lain submerged until th deepening of the outlets permitted their drainage. But this period was, by hy pothesis, that when a geologic winter was merging into a geologic spring There was not yet a summer climate; and the annual winter must have con gealed the surfaces of the abounding lakes, and arrested the superglacial tor rents, if it did not materially dimnish the flow of the sub-glacial ones.

I think the steps of this reasoning safe and sound. But we have here an over looked condition or glacial agency in the natural order of sequence, which, i seems to me, is adequate to explain the transpositions of rock-masses to which I have referred. There were regions in these lakes where rocky formation rose nearly to the surface or projected to a slight extent above it. On freezing of the watery surface, these would be firmly embraced in the ic Meantime, as the supply of water is diminishing through the advance of the nual winter, the lake subsides, and the frost takes hold of the exposed rock a greater depth. But the annual spring and summer return. The supply water increases, the surface of the lake rises and the floating field of ice sheets of previously half-disjointed limestone, and floats them in the d whither the current sets or the wind blows. They may be dropped some northward from their native bed, and may lodge upon an accumulation of moved by aqueous agencies quite inadequate to move cubic yards of rock. I think that ice-floes are capable of such work; and I believe it is essentially different from work in progress in the tracks of Arctic currents modern times.

The same agency would have picked up and transported the rounded north ern boulders, which we find scattered, also, to some extent, through the sands.

It could not be expected that the existing configuration of the surface o the State should preserve the features which determined the existence and boundaries of such local lakes as I have supposed; but, after all, are not our existing interior lakelets examples of the same, perpetuated by the delayed erosions of outlets? If it be asserted that neither the less nor the greater

*This idea was first impressed upon my attention by my brother, N. H. Winchell, who has studied the Drift with much assiduity. See his papers in Proc. Amer. Assoc., Dubuque Meeting, 1872, and in the "Popular Science Monthly" for June and July, 1872.

n transportation of limestone masses, in our times, it will
ɔjoinder to remind the reader that the supply of movable masses
must ultimately have become exhausted. Still, it is not a fact that
tind has entirely ceased, as any one familiar with the flotsam
a lake beach will be led to admit.

ɔbliterated all traces of that topographical configuration which
may have determined an ice-float toward the north. Be-
Bay and the mouth of the Grand River is a broad depression,
of which rises but 72 feet above Lake Michigan. The south-
n the State presents an elevation of 300 to 600 feet above
ne Corniferous limestone barrier passing through Monroe
still maintains an elevation of 100 to 150 feet above the
we not here some vestiges of that ancient conformation of
resulted in a northward drainage into the great channel once
and the northward transportation of ice-borne sheets of
wrenched from the elevated barriers in Hillsdale,
ɔunties, and the contiguous portions of Ohio and In-

OCEAN CURRENTS.

BY REV. LEIGHTON COLEMAN, S. T. D.

disputed questions in regard to the physics and natural
that in relation to ocean circulation has long been one of
.

and counter-currents of the ocean are extremely complicated,
causes and courses of some of the main streams are discernible
much to be done in this department of Hydrography.
engaged the earnest attention of many foreign scientists, it was
of our own countrymen—the late Com. M F. Maury—to give
even yet seems to be the main text-book upon this subject.
written upon this theme—such as Page, Ansted, Somerville,
they appear to base their conclusions mostly upon those of
Expedition accomplished a greater result than had
any recent similar effort. In what follows, I lay no claim
chief aim will be to present a brief synopsis of the lead-
developed, in language which shall be generally intelligible,
in many instances quotations from different authors, which I
to alter.

to the least scientific observer that there are in the ocean cur-
extent, magnitude, and velocity which disturb its tranquility.
depend upon circumstances as permanent as the globe itself,
causes.

or fresh, ever seeks its level, and incessantly flows from
places towards the depressions. Every atmospheric varia-
in a displacement in one direction or another of the superficial
great currents which flow with a regular movement around the
ocean, are determined by general causes acting at the same time

on the entire planet. These causes are the sun's heat and the earth's rotation on its axis.

In descending from the poles to the equator, and thus crossing latitudes whose speed of rotation is greater than their own, the waters are drawn obliquely towards the west, and this continual retardation motion of theirs behind that of the rotation of the globe, becomes, in relation to the surface of the sea, an apparent motion from East to West. Upon their meeting in the tropics, the polar currents, being both affected by a side movement, strike each other obliquely, then reunite in the same oceanic river and flow directly toward the West in the opposite direction to that of the solid earth. It is thus that the equatorial current is produced, which, with the two polar currents, determines all the movements of the waters in each oceanic basin. The other rivers of the sea are simply branches from them, caused by the form of the continents.

The Atlantic and Pacific have each their double circulatory system, formed of two immense eddies united in the torrid zone by a common equatorial current.

The currents of the ocean depend chiefly upon the unequal temperatures and densities of its different regions—the colder and warmer, the denser and lighter, the salter and fresher, incessantly tending to interchange and equilibrium. These currents are either constant, periodical, or variable: the *constant* depending upon the combined influences of unequal temperature and densities in the waters of the ocean, the rotation of the earth, and the trade-winds; the *periodical* upon the tides, the monsoons, and the sea and land breezes in tropical countries; and the *variable*, such as may be produced by local peculiarities in the tides and winds, the melting of ice in polar regions, and other similar causes.

Prevalent winds, narrow and enclosed seas, long lines of coast stretching from the poles towards and far beyond the equator, broken and jagged coast lines, and lines of submarine hill crossing the general direction of an ocean at right angles, are all modifying agents affecting the continuous movements of the sea, and inducing, modifying, or checking currents.

Again, it is claimed by Dr. Carpenter that the results of the Challenger expedition, already referred to, prove that apart from the horizontal circulation produced by the action of winds upon the surface of the ocean, there is a vertical circulation maintained in consequence of the difference between the Polar and Equatorial areas, the whole mass of water contained in any ocean-basin in free communication with both being divided into two strata, of which the lower constantly, though slowly, flows over the ocean-bed from the Pole toward the Equator, while the upper is as constantly flowing from the equator toward either pole.

Of all the various currents, that which is known as the *Gulf Stream* of the Atlantic is the most important. Doubling the Cape of Florida, it flows northeast in a line almost parallel to the American coast, touches the southern borders of the banks of Newfoundland, and thence, with increasing width and diffusion, proceeds across the Atlantic, until in the region of the Azores it spreads out into two great branches, one curving northward and the other flowing southwards.

There are various theories concerning this great stream, much attention having been given to it by scientific students, but all are agreed as to the inestimable effect it produces upon climate, navigation, animal and vegetable life. It is certainly larger than that of all the rivers of the world together. We have not space here to notice in detail a discussion of no little interest concerning the influence of the Gulf Stream upon the climate of Northwestern Europe, which has arisen between Professor Wyville Thomson, of Edinburg (following the lead of Dr. Petermann and others) and Dr. Carpenter, the latter of whom

he views of Sir John Herschel and Admiral Irminger, of the Danish
:hat if any of its extensions really reach those shores, they car-
nttle or no warmth.
ury alludes to observations which have been made to prove that the
is roof-shaped, causing the waters on the surface to flow off to
rom the middle, which current, however, is but superficial, not be-
to affect the drift of a vessel.
e..perature there is, in a winter's day, off Hatteras, and even as
:he Grand Banks in mid ocean, a difference between its waters and
ocean near by of twenty and even thirty degrees, the former being
therefore lighter.
ters have expressed the opinion that the coasts of the United States
als of Nantucket turn the Gulf Stream to the east, but it would
he best authority, that its course is governed by the same law of
otion as requires the planets to revolve in orbits,the planes of which
rough the centre of the sun.
ice upon the metereology of the sea has been already indirectly con-
s relations to commerce and navigation would form an interesting
lf. It was Dr. Benjamin Franklin who first suggested its use as a
ving navigators their latitude and of warning them of their approach
s of this continent. Through his discovery, the ports of the north
as accessible in winter as in summer, and since the application of
neter to the Gulf Stream, the average passage from England has
y reduced.
itorial current, flowing westward from Africa to the Gulf of Mexico
lf Stream, thence eastward to the Azores, and thence curving south
ice a great whirl, in the centre of which there is the still water of
o, or Grassy Sea, swarming with life peculiarly its own, and forming
nost remarkable features in the Geography of America. Columbus,
st discovered it, supposed it to be the limits of navigation, and be-
ed. At a little distance, it looks as though it were substantial
walk upon. Patches of the weed are always to be seen floating along
ream. The Atlantic Ocean being the basin to the Gulf Stream, the
ea is the centre of the whirl.
ng the Gulf Stream and the Equatorial current, are two. Rennel's
ward along the coast of Spain and France to Ireland, and the North
rrent runs southward into the Equatorial current. While there is
of opinion on the point, yet the weight of scientific conclusions seems
rate that there is an under current both from the Red Sea and the
ean, and it is accounted for by the salts of the sea.
ion to the Arctic and Polar, and the Antarctic and South Atlantic
e have in the Indian Ocean the Mozambique, Agulhas or Cape cur-
Humboldt's (This latter is sometimes described as belonging to the
ean,) or Peruvian. These are active ones, and convey immense vol-
ater containing vast quantities of salt, requiring to supply the waste
d and by evaporation, large volumes of water to flow into or return
at inter-tropical basin. Along the coasts of Australia, we have what
he New South Wales Current. Others of less note are partially

rents of the Pacific are less definitely kno n than those of the At-
the North Pacific there is a kind of Gulf Stream known as the Black
Japan. In shore of, but counter to, the China current, along the
of Asia is found a streak or layer, or current of cold water, an-
between the Gulf Stream and the American coast. It is not

strong enough sensibly to affect the course of navigation, but, like that in the Atlantic, it is the nursery of valuable fisheries.

Time forbids a further discussion of this theme, a theme, it may be remarked, not at all unpractical, but one of very great importance whether we consider nature or history.. In the effects of all these currents in equalizing differences and softening extremes of climate, maintaining the equilibrium of the ocean, tracing the great lines of communication upon its highways, favouring or obstructing the intercourse of one nation with another, bringing near together places, apparently the most remote, and separating others that seem almost to touch each other, we have enough to stimulate us to acquire much more accurate knowledge of this whole subject, and to be grateful to those who have already given to it so much of their time and attention.

INFLUENCE OF CLIMATE IN THE DISTRIBUTION OF DISEASE.

BY W. C. CHAPMAN, M. D.

Although the subject of disease and its relations to humanity more properly belongs to the science of medicine, yet there are so many points of interest to the general scientist, that many questions may be profitably discussed by others than the medical profession. In fact, the question we now propose to consider, owes its present development to the investigations of those who are in no way connected with the science of medicine. The understanding of the relations which exist between certain meteorological conditions and peculiar classes of disease cannot fail to be of great importance to the scientific, as well as the general public.

In the study of climatology is embraced the various causes which may modify the climate of any given country or section of country, as temperature, moisture, geographical position, character of the vegetation, rapidity of the flow of water courses, character of the soil, etc., etc. Without such investigation an important cause of disease may in many cases be overlooked, and the facts, given as such, be entirely useless. Such being the case, the question becomes far too broad to be confined to one class of scientists, but all are called upon to aid in the perfection of a branch of study which will benefit mankind in all its interests.

The United States Government, recognizing the value of meteorological observations taken simultaneously at various localities, has established such observatories at which all atmospheric changes are carefully noted many times during the day and reported to the central office at Washington, where they are tabulated and published daily in the papers in every section of the country. Recently arrangements of an international character have been made whereby simultaneous observations are taken and transmitted from at least five hundred stations located at points on various portions of the globe. When this system has been in operation for a greater length of time, it is hoped that much knowledge of a scientific character may be gained that will benefit mankind, and

link in the chain that binds nations together by the tie of com-

been but few years since any attempt has been made to investigate the
of the distribution of disease over the world, and yet much has been
the presentation of facts to cause the science of Hygiology to take a
as a branch of the science of medicine.

in opening a chapter on this subject, says: "This department
of Medicine treats of the manner, and endeavors to investigate
under which diseases are distributed over the world, or are con-
districts. It embraces a consideration of topics which consti-
basis of Hygiology, and which are of the greatest importance to Prac-
of the utmost interest to Science, and of inestimable value in
It embraces the medical application of the facts of *physi-*
combined with those of *vital statistics*, and it has been various-
GEOGRAPHY, or NOSO GEOGRAPHY."

to arrange diseases in zones or belts, thus forming certain
disease. These realms correspond in many cases with certain mean
lines. So distinctive is each Zone, that the terms tropical, temper-
have been applied to them. It is true where the different zones
each other there is to a certain extent an overlapping, and diseases
both realms may occur, but so modified by the difference of climate
cases it is difficult to recognize them as the same.

previously referred to says: "There are facts which show that
are so completely under the influence of temperature that they
of being arranged systematically in zones of geographical dis-
the diseases susceptible of being thus classified are those of a com-
type, which require a certain range of temperature and concurrence
conditions for their prevalence and propagation. They are chiefly
plague, typhus fever, typhoid fever, and *cholera*. The geograph-
ion of these diseases into zones, north and south of the equator,
be regulated in a great measure by relative degrees of temperature
in the several places where they prevail in America, Asia, Africa
Such diseases as have been mentioned, and whose realms are
a great measure by isothermal lines, are not only associated with lo
characteristic vegetation, with heat and humidity, but they also
physiological habits of the several inhabitants of the different lati-
larious fevers, yellow fever, plague, typhus and *typhoid fevers* have
climates where each predominates, and beyond the limits of which
s rarely, if ever, perpetuated when imported, unless change of sea-
rise to a state of climate analagous to that in which the specific dis-
to flourish."

boundary of the tropical realm has been placed at the isothe-
deg. Fahrenheit; the southern boundary at the same mean de-
It embraces all that portion of the western hemisphere
between the southern border of the United States and the region of
upon the Amazon River. On the eastern continent the zone
broader and includes nearly the whole of Africa, Arabia, India, China
northern portion of Australia. Diseases in this portion of the world
themselves the most malignant forms, and the mortality among the
s very great, averaging 46 per 1,000, according to some authori-
diseases which prevail in this zone are the various forms of *malarial*
yellow fever, inflammation and abscess of the liver, and *chol-*
diseases appear with great intensity in those localities where the
heat prevails together with a condition of great humidity. The mal-

arial fevers are especially prevalent in the neighborhood of marshes and shores of sluggish rivers. According to Aitken "the great centers of these malarious diseases in the different continents are: In America—the shores of the Gulf of Mexico, the West India Islands, and the northern portion of South America. In Asia—India, China, Borneo, Ceylon. In Africa—the countries around the Gulf of Guinea on tne west, Madagascar and Mozambique on the east, Algeria and the shores and Islands of the Mediterranean on the north."

The temperate realm of disease is the most healthy region of the globe, and embraces all that portion of the world situated between the isothermal line of 77 deg. and that of 41 deg. On the western hemisphere, this embraces nearly the whole of the United States, (northern New York and the New England States belonging more properly to the Polar Zone) and south of the equator nearly all of the region south of the River Amazon. The countries north of the equator on the eastern hemisphere embraced in this realm are the British Isles, Norway, Sweden, and all south and southeastern Europe, with a small portion of Asiatic Russia; south of the equator, the Cape of Good Hope and southern Australia are the only regions belonging to this realm.

All forms of continued fevers are found in these countries, malarial diseases also existing in many localities, but not with the same malignancy as in the tropical realm. When imported, other diseases, as yellow fever and cholera, may prevail to an alarming extent during those months in which the temperature more nearly approaches the climate to which they naturally belong; a fall in the thermometer to a point below freezing is nearly always sufficient to modify or exterminate the intruder. The great scourge of this region is consumption, which abounds more or less everywhere. Local conditions modify its prevalence so that many regions are comparatively exempt from its ravages.

The last disease realm to be studied is that which lies to the north of the Temperate Zone. In the southern hemisphere, no inhabited countries being known, nothing can be said of them. This region includes Canada, New England and all the country north, and on the eastern continent, Russia, Iceland, and Siberia. All catarrhal affections here prevail, with erysipelas and diseases of the skin and digestive organs. Malarial diseases sometimes present themselves, but only during the summer months. Catarrh is really the scourge of this realm, and the mortality is often great from this cause alone.

The foregoing facts are well established, and the diseases indicated as belonging to the several realms have their origin and development in those regions of the world that present the proper conditions of climate as designated by the mean of temperature and other meteorological conditions. Still there are localities which, from surrounding circumstances, present characteristics much more strongly marked than others contiguous and lying in the same zone of disease. We mentioned that in those localities where the lines of greatest heat and humidity come together in the tropical realm, there the diseases which are the marked characteristics of warm, wet climates are the more malignant and devastate the country at a fearful rate. There are sections of country even located in the Temperate Zone, which approach even the most deadly regions of the tropics, as the Pontine Marshes, of Italy, and southern portions of our own country.

In the Temperate Zone there is another cause for development of disease which does not occur in warmer climates, that is the contaminating influence of large cities. Almost all of the large cities of the world are located in this portion of the globe, and the mortality of these is notably greater than in country neighborhoods. Thus the proportion of deaths is greater in cities than in a much larger extent of territory with the same population, known to be naturally more unhealthy, even if located in the tropics.

Those diseases which we have classed as belonging especially to the temper-

also occur with varying degrees of intensity, modified by condi-
o certain localities. Thus we find malaria abounding at one
ysentery and diarrhoea at another, and consumption and rheumatic af-
at another, so that one locality is known for healthfulness and another
unhealthy condition.

s not always easy to give all the reasons why diseases should be
to a much greater extent in one portion of a country than another,
rrounding circumstances appear to be similar, in fact there are some
lisease which sometimes sweep through a country, setting at defiance
rules whereby previous epidemics have been governed. During the
Southern Ohio was visited by an epidemic of scarlet fever. In Cin
were 410 deaths from that disease alone. The Health Officer of
eports for that year: "No month was exempt from scarlet fever, al
were only 15 deaths from the disease during the first four months
Only one of these occurred in April. After that, the deaths from
increased each month, until there were from it 113 deaths in
This great mortality occurred in, and was not prevented by, the
Summer, although it has been long known that in almost all epi-
scarlatinous tendency is almost entirely destroyed where there is
high temperature, ranging from 80 to 85 deg. Fahrenheit."—
Cin. Lancet.)

diseases generally occur during the warmer season of the year,
known that a temperature below freezing generally eradicates the
he disease. Still cases of ague do frequently occur during the months

hese exceptional cases, still enough has been proven to
ne conclusion that there exists a certain relation between disease and
hat much may be done toward the stamping out of epidemic in-
r the causes of their origin, and the conditions under which they are
are as fully understood, as is possible by a study of the subject.

United States we find all of the diseases incident to the temperate
rring with more or less frequency and virulence as one or another lo-
present the proper conditions for development. In those States bor-
n the Gulf of Mexico the forms of disease more nearly approach
he tropics, while on the borders of the Northern Lakes and Canadas,
and influenzas of the polar zones frequently occur

second volume of the Ninth Census of our country, entitled "Vital
of the United States," much attention has been given to the study of
ution of disease through various States or portions of States, and
of the map and tables presented, much valuable information may

diseases in this country Consumption claims by far the greatest num
tims. During the census year 1870, there were 69,896 deaths from
in a total mortality of nearly half a million (492,263) or one-seventh
deaths occurring during that year. Some portions of the country are
from this disease, while in others the mortality is frightful. The
States are notable for the extent and fatality of this malady.
owing table [taken from the Vital Statistics of the Ninth Census]

shows those portions of country where the disease is most common, and the proportion of deaths from this cause compared with all other causes:

States and Territories.	Deaths from all causes to one death from Consumption	States and Territories.	Deaths from all causes to one death from Consumption.
1. Maine	3.9	10. Oregon	5.6
2. New Hampshire	4.5	11. Kentucky	5.7
3. District of Columbia	4.6	12. West Virginia	5.7
4. Massachusetts	5.0	13. New Jersey	5.8
5. Rhode Island	5.0	14. Maryland	5.8
6. Vermont	5.0	15. Michigan	6.0
7. Delaware	5.3	16. New York	6.0
8. Connecticut	5.6	17. Tennessee	6.0
9. Ohio	5.6		

As of value for comparison the following table is given of those localities where there is more or less exemption from Consumption, the figures being taken from the same report as the preceding:

States and Territories.	Deaths from all causes to one death from Consumption.	States and Territories.	Deaths from all causes to one death from Consumption.
1. New Mexico	26.2	9. Arkansas	14.2
2. Nevada	20.5	10. Utah	14.1
3. Wyoming	18.5	11. Mississippi	13.2
4. Florida	17.3	12. Colorado	11.7
5. Texas east of the Colorado River	16.9	13. Nebraska	11.5
6. Georgia	15.6	14. South Carolina	11.2
7. Texas west of the Colorado river	15.0	15. Kansas	11.0
8. Alabama	14.2		

It will be observed by comparison of the foregoing tables, that the temperature of a certain locality alone, does not exert an influence either in developing the disease or in preventing such development. It is, however, noticeable that those States which are noted for their changes of temperature are the ones in which there is the greatest mortality from Phthisis. Denver City, situated at a great altitude, with a mean temperature for the year of 44 deg. Fahr., is considered by consumptives as desirable for a place of residence, as sunny Florida with its lowlands and annual mean temperature of 72 deg. Fahr.

At one time it was considered impossible for consumptives to exist in those localities in which diseases miasmatic in character prevailed. This has been proved not to be a fact; but while it is not impossible for the two forms of disease to exist together, still, from consideration of the tables which follow when speaking of malarial diseases, we shall find that in the United States those localities which are freest from malaria are the ones where Consumption does abound. and although there can be no reason for believing that those causes which develop the one form of disease are antagonistic to the development of the other, still the fact remains that the two diseases do not, in this country at least, present the greatest mortality in the same localities.

An able writer, (Prof. Flint) says: "Climate appears to exert an influence either for or against the development of the disease. It may be stated that, as a rule, the prevalence of the disease is less in climates, either uniformly warm and dry or uniformly cold and dry, than those which are moist and subject to frequent alternations of cold and warmth. Major Tullock's reports to which all writers refer, showed that among British troops the ratio of deaths from this disease was greater in some tropical situations, such as the West Indies, than in Canada and Nova Scotia. These statistics, however, are of little value as regards the influences of climate, for, assuming accuracy of diagnosis, the soldiers carried with them constitutional tendencies acquired elsewhere, and the circumstances connected with their habits and mode of life may have had

to do in the causation. That this criticism is just is shown by the fact eturns of mortality among the officers give a different result. The disease to a much greater extent in cities than in the country, showing doubt- tne operation of auxiliary causes in the former. It prevails more on the ooard than in inland situations. The elaborate researches of Professor go to show that in the State of Massachusetts cases occur more fre- in localities in which the atmosphere is rendered humid by streams or There is no foundation for the opinion that the terrestrial emana- known as miasmatic, afford any protection against the disease. Newly d places are frequently exempt for some time, from its prevalence to much t; but the explanation of this fact is, the pioneers who compose the popu- in these places are persons, generally of sturdy, vigorous health, and the s of life in such a population, are protection against this disease. As re- season, the disease is oftener developed during the spring months and the onths of summer than at any other portions of the year."

ct to consumption, pneumonia presents the greatest number of deaths United States. The localities where this disease is the most frequent, ot those in which consumption most frequently prevails, and the same tic influences do not act as a cause in its production. Tbe disease occurs oftener in the Middle and the Southern States than in those of the North, uring the winter the mortality is much greater than during the other sea- of the year. Those persons who are exposed to the vicissitudes of the ier are especially liable to suffer from the disease. In those regions where ial influences abound, pneumonia appears to be more frequent, and of more gravity when it does occur. In an essay published by the Sani- Commission, in 1868, Austin Flint says: "Of the diseases which the surgeon must encounter in the present unhappy contest, pneumonia is f the most important. This disease has already occurred to a considera- ctent among the troops on the Potomac and in the West; but it will doubt- prevail to a much greater extent during the months of winter and spring. vails habitually much more among the inhabitants of the Middle and ern States than at the North. It will be more likely to occur among ern soldiers in a southern climate, than among native or acclimated resi- . Statistics show that it occurs much oftener among those who are ex- to the vicissitudes of the weather than among those whose occupations re confinement in-doors; hence it may be expected to prevail especially g troops in active service. Not only the prevalence, but the gravity of lisease is greater in the Middle and Southern than in the Northern States. ger ratio of deaths in the former than in the latter is to be expected. In ons where periodical fevers are rife, pneumonia is apt to be extremely fa- This is the uniform testimony of physicians practicing in malarious re- , especially at the South."

e number of deaths from pneumonia in the United States during the year was 40,012. being a little over one twelfth of the total mortality.

e following table, taken from the Ninth Census reports, shows those lo- es where the disease was the most prevalent during the year 1870:

tates and rritories.	Deaths from all causes to one death from Pneumonia.
kansas,	5.1
izona.	6.0
xas east of the Colorado River	6.7
abama	7.2
	7.6
	7.8
	8.4

	States and Territories.	Deaths from all causes to one death from Pneumonia.
8.	Georgia	10.0
9.	Missouri	10.0
10.	South Carolina	10.4
11.	Kentucky	10.5
12.	Virginia.	10.5
13.	Utah	10.6
14.	Tennessee	11.0

Intestinal diseases, as Diarrhoea, Dysentery and Enteritis, take the third place in order of frequency in the United States. During the census year 1870 there were 31,153 deaths from these diseases, being nearly one-sixteenth of the total mortality.

It would be well, if possible to investigate each of the diseases mentioned above, independently of each other, but space forbids. It is doubtful, however, whether climate has any direct relation with either diarrhœa or entertis, as a causative agent. It is true that both these diseases do occur more frequently during the summer, but other causes are certainly more active in developing the disease, even during the warm season, than heat alone. Thus we have the unripe or over ripe fruits in abundance, an enervated condition of the system, and an excessive use of ice water. During the summer there is much irregularity in the habits of life, occasioned by change of locality as in traveling, etc. This irregularity has a tendency toward a development of diarrhoea, irrespective of the climate visited.

Dysentery, however, has a direct relation with climate, so far as a modification of type and malignancy of the disease is concerned. Although many writers consider temperature as one of the most potent agencies for the development of the disease, still we fail to find any proofs, from tables before us, of their relation as cause and effect. Wisconsin comes fourth in the enumeration of States when considering the frequency of intestinal diseases. During the year 1870, there were 296 deaths from diarrhoea, 265 from dysentery, and 280 from enteritis. This State has a mean temperature for the year of about 42 deg. Fahr. Missouri reports during the same time 13,000 deaths from diarrhoea, 503 from dysentery, and 467 from enteritis, mean temperature 54 deg. Fahr. Georgia, in 1870, reports 448 deaths frsm diarrhoea, 327 deaths from dysentery, and 239 from enteritis; mean temperature, 64 deg. Fahr. We do not understand from such statistics that temperature alone should be considered as exerting any special influence in the development of intestinal diseases. The following article, taken from the reports of the Sanitary Commission previously referred to, will substantiate most fully the statements made above. Coming from such high authority as Prof. Alfred Stille, of the University of Pennsylvania, they cannot but be received with consideration.

"Almost all writers agree in stating that dysentery is much more common and fatal in hot than in cold climates, and doubtless this statement is true particularly in regard to the endemic disease. But it is nevertheless true that the prevalence of the disease in temperate climates is so great at times that of fifty-four notable epidemics of dysentery which are recorded as having prevailed in Europe and this country, all but eight occurred in localities where the winters are cold and the summers of moderate temperature. From the equator to the arctic regions there is no region where dysentery has not assumed the form of a destructive epidemic; and if fewer records of its ravages in hot climates exist, perhaps it is because the inhabitants are not accustomed to give their medical experience a place in their scanty literature.

"The passage from summer to autumn is the season when dysentery is most prevalent. Of fifty recorded epidemics, thirty-six occurred at this period of the year. The most evident conditions for its generation are hot days and cool nights. It has been found to occur when these were apparently the only morbid influences; but frequently another atmospheric condition peculiar to that season of the year exists simultaneously, viz.: moisture in the form of exhalations from the ground, or, more commonly the precipitation of water from the air by its contact with the colder earth or with the surface of rivers, ponds, etc.; in other words, cold fogs. By them, perspiration, excited by the day's heat, is suddenly checked, and the discharge of the effete results of the decom-

rom the skin, which the heat doubtless renders unusually active, ab-
eases, the form of the recoil falls upon the organ which at the end of
ummer is weakest, and probably finds an exit through the specific chan-
the glands of the rectum and colon, which are the primary seat of organ-
in dysentery. In all epidemics of dysentery occuring at the period
to, the disease begins to decline on the near approach of cold
and generally ceases to prevail by the month of November."

sentery, as has been mentioned, is of a more malignant type in the tropical
ns than in the more temperate ones, and still heat alone does not produce
isease. There are certain conditions of climate, taken in connection with
h temperature that seem to be productive of the disease.

of. Huebner, of Leipsic, has contributed a very valuable article on dysen
which is published in Ziemssen's new "Cyclopædia of the Practice of Med-
" from which we take the following: "We may, then, adopt as the cause
demic and endemic dysentery, a miasma which is developed under the in-
es of a tropical climate. or of one resembling a tropical climate, in a soil
ertain moist and perhaps swampy character, in an analagous way with mala-
oisoning, i. e., under conditions which exist is some parts of the tropics
year; in the temperate zones only from time to time. We must not however,
se that dysentery poison and malaria poison are identical, which is cer-
not the case, for there are many fever regions where there is no dysen-
as on the Peninsula ot Gdzarat, in India, and vice versa."

e following table is presented here in uniformity with preceding tables,
hows the States and Territories in which intestinal diseases more fre-
ly prevail in our own country:

States and Territories.	Deaths from all causes to one death from diarrhoea, dysentery, and enteritis.	States and Territories.	Deaths from all causes to one death from diarrhoea, dysentery, and enteritis.
lh, ...	8.7	8. Louisiana.....	12.7
orado	9.1	9. Michigan.....	13.0
kota	11.2	10. Illinois	13.2
sconsin.	11.8	11. Georgia.....	13.4
ra	11.9	12. South Carolina.....	13.7
isouri....	12.3	13. Mississippi.....	13.8
nesota	12.6	14. Montreal.....	13.2

ere were 23,957 deaths from typhus and typhoid fevers in the United
s during the year 1870, deaths from this cause being one-twentieth of the
mortality of the country.

hough these two diseases are classed together still they are by no means
nd the same. They originate from different causes, and pass through all
e with very few symptoms in common. One, typhoid, is infectious, while
is is highly contagious.

e temperature of a locality seems to have but little to do with the devel-
nt of either form of the disease; but certain local conditions are well
n as presenting all that is requisite for their introduction. Typhus fever
irst known as occurring in Ireland, and during two years, 1817 to 1819,
0 persons died from the disease. Other portions of the world have also
red many epidemics of typhus fever, and the United States has by no
is been free from its invasions. As to its primative cause, most authori-
ire united in attributing it to a specific germ formation, and although the
hat such is the case cannot be exactly proven, yet enough is known to
little doubt that the disease is developed and spread in all directions
the agency of this specific germ.

nfluence which climate may exert is not very well understood. Heat
or cold and moisture do not seem to modify the disease in the

least. The disease is so contagious in its nature, and capable of being conveyed by clothing or other means to such great distances, that it is impossible to arrive at any facts as regards the influence which climate may exert in its development. Some have supposed that it is more prone to appear in damp, marshy places, but this fact also needs confirmation.

A glance at the table at the close of this subject shows that in our country at least, one portion is as liable as another to the appearance of the disease.

One authority (Prof. Lebert, in Ziemssen's Cyclopædia) says: "The meteorological conditions are by no means constant in the different epidemics, and typhus is still more independent of the seasons than typhoid fever, as has been proven by Hirsch in his analysis of the periods of occurrence of thirty-five epidemics. The conditions of the weather, especially with regard to temperature, have hitherto been found to possess no decided influence. Nevertheless, I firmly maintain what I have just stated, that the influence of the rise and fall of the ground water may possibly be great, yet I would not lay too much stress upon this, though favored by what we know of other infectious diseases, particularly of typhoid fever in Munich. With this corresponds the fact that a series of observations exists, which show that typhus occurs with a certain predilection in low and damp places, though Hirsch properly insists that these elements are by no means necessary for the production of typhus. Through importation, typhus may occur tolerably high above the sea level; for I observed quite a number of cases in 1839 in the Salvan Valley, which lies 4,000 feet above the level of the sea, they having been transferred from the plain below."

The influence of climate is more marked in typhoid than in typhus fever. All countries suffer more or less from the disease. Autumn seems to be the portion of the year when it is most prevalent. There are many authorities who believe that typhoid fever is propagated by contagion, but the cases occur so rarely which originate by direct transmission from person to person, that it is exceedingly doubtful whether it is ever transmitted directly. Even nurses who are constantly at the bedside, escape without any symptoms of miasmatic poisoning.

The question now arises as to whether there are any meteorological changes that can act as causative agents in the spread of the disease. If we accept the theory which seems to be proven as a fact, that typhoid fever can only originate from a specific typhoid poison, it only remains for us to show what atmospheric conditions are necessary for the transmission and multiplication of the poisonous germs, and thus produce an epidemic of the disease. It is assumed that the poison must emanate from an individual suffering from the disease. The latest pathologists doubt whether the excrementious matter from the poison contains the poison fully developed when still fresh, and it would seem that the action of the air upon the poisonous germ is necessary for its developent. Cesspools and sewers, therefore, frequently become centers from which the poison passes into buildings and infects the inmates.

The water of wells and springs often become sources from whence the poison spreads itself. Whole neighborhoods have been infected by the use of a common well, into which washings from vaults and sewers have been permitted to percolate. The following, taken from an article by Liebermeister, is only one of many which might be produced to substantiate the statement made above: "Epidemic in Soluthum, 1865.—In a locality supplied by a certain aqueduct during the period between August 15 and September 15, a number of persons were attacked with typhoid fever; 82 of these cases are described with their names. Almost all the houses supplied with water from this aqueduct contained cases of typhoid, while other houses, near and between these, but with a different water supply, escaped entirely. In the barracks, which were sup-

:he aqueduct, numerous cadets and instructors, collected from the :antons, were attacked with the disease. The disease commenced 14 :heir moving into the barracks; in 11 days, 32 were attacked, and :hen being given up, after its dismissal 10 more were attacked. Out 42 were attacked with severe typhoid, and eight died. At the tne disease appeared among the other dwellers in the barracks, al- oefore that time there had never been a case of typhoid there. It was)n examination, that a brook which passed through the court of the lu- um, Rosegg, and received its sewerage, ran into the aqueduct. In was a nurse who had recently come from a typhoid locality. This was taken sick with typhoid fever about the middle of July, and died 8. The clothes of this patient were washed in the wash-house of the by order of the director, and many soiled clothes were even soaked in)k itself. After the middle of August the epidemic appeared through- entire locality supplied by the aqueduct."

' instances similar to the above might be given, showing how, from ex- titious substances, the drinking water had become contaminated. Often iure thrown upon the land is washed off by the rain into streams which many communities with water. Frequently epidemics of typhoid have ed in this way and the cause remained unknown. In various localities re, the streams of water may be instrumental in spreading disease and a their immediate neighborhoods.

)ugh climate itself cannot be said to influence the spread of these of disease, still it is well to understand that whole neighborhoods invaded by this insidious foe, and in all cases every attempt should be)discover the channels through which it so rapidly spreads death and ' around.

)llowing table, showing the States and Territories in which the greatest :y occurred during the year 1870, from typhoid and typhus fever, the ken from the census reports for that year:

es l ies.	Deaths from all causes to one death from typhoid and typhus fevers.	States and Territories.	Deaths from all causes to one death from typhoid and typhus fever.
a.	11.3	9 Connecticut	14.6
Mexico	11.7	10 Georgia	14.9
Carolina	12.0	11 Washington	14.8
	12.1	12 Michigan	15 7
Carolina	13.1	13 Vermont	15.7
sota	13.2	14 Iowa	16.8
a	13.8	15 Delaware	17.0
Hampshire	14.0	16 Illinois	17.4

der of frequency, scarlet fever comes fifth among the diseases of the States, and no portions of the country are exempt from its invasions. ly there is no one disease that is more widely diffused over the globe is, and none in which the various epidemics differ so much in character. are, however, zones of comparative immunity in both hemispheres. se are not free at all times from its ravages. In our own country, the bordering on the Gulf of Mexico appear to be freest from the incursions lisease. Dr. T. C. Minor has prepared and published in the *Cincinnati and Observer* an elaborate article upon "Scarlet fever in the United ' from which we take the following as regards the character of the cli- the zones where there is more or less immunity from the disease:

'haracter of the climate in the zones of comparative immunity may be stated; Lying for the most part in the tropics and near the equa- :he direct rays of the sun, a high mean annual temperature is,

of course noticeable. Again, the zones of comparative immunity from scarlatina are the points where the lowest forms of malarial fevers are common. Yet, again, these zones being near the equator, are subject to the heavy periodical rain falls of the tropics, and have at times an atmosphere fairly saturated with humidity.

"We are led to conclude for these reasons, that a very high temperature, combined with a periodically humid atmosphere, is unfavorable to the development of any scarlatinous tendency."

Farther along in his article Dr. Minor says: "A study, from this special point of view, of numerous statistics, not included in this paper, has led me to believe that various changes, produced by temperature, serve to influence the disease, and that these changes were brought about only by a very high temperature."

"The following propositions may stand or fall, if the requisite proof to the contrary be given:

1. "The scarlatinous tendency is but slightly, if at all, modified by a temperature ranging from zero to 65 deg. Fahr.

2. "The scarlatinous tendency is decidedly modified and lessened by a temperature ranging from 75 to 80 deg. Fahr.

4. "The scarlatinous tendency is almost entirely destroyed where there is a prolonged high temperature ranging from 80 to 85 deg. Fahr."

The whole number of deaths from scarlet fever in the United States during the year 1870 was 20,320 or a little over one-twentyfourth of all the deaths for the year. The following table shows the localities in which the disease was most fatal:

	States and Territories.	Deaths from all causes to one death from scarlet fever.		States and Territories.	Deaths from all causes to one death from scarlet fever.
1	Nevada	4.3	9	Illinois	15.5
2	Pennsylvania	9.4	10	Michigan	15.8
3	Wisconsin	9.8	11	Maine	18.3
4	Nebraska	11.1	12	New York	20.4
5	Kansas	12.8	13	Connecticut	23.7
6	New Jersey	13.5	14	Utah	24.7
7	Rhode Island	14.7	15	Missouri	26.6
8	Minnesota	14.8			

The effect of temperature in the development of scarlet fever is forcibly shown by comparing the following table with the one given above:

	States and Territories.	Deaths from all causes to one death from scarlet fever.		States and Territories.	Deaths from all causes to one death from scarlet fever.
1	Texas west of the Colorado river	2182.0	7	South Carolina	410.0
2	Georgia	1133.8	8	Arkansas	382.4
3	Alabama	828.5	9	Mississippi	382.1
4	South Carolina	756.2	10	Virginia	353.0
5	Tennessee	491.0	11	Florida	226.4
6	Texas west of the Colorado river	474.5	12	Louisiana	213.2

The last forms of disease to which we will ask attention in this article, are those which arise from malarial poison, and although statistics do not show as great a mortality record from this cause as many others, it is doubtful if there is any one form of disease that brings discomfort to a greater number of people than this one. There is probably no section of country of large area in any portion of the world beyond the regions of snow and ice, where the malarial influence may not at some time be felt, and though the character of the disease may vary as the climate of localities varies, still the same agent is active as a developing cause.

of Germany, western portions of France. southwestern
ol and Portugal, and especially the western coasts of Italy are fa-
lor malarial fevers. In Asia the disease is met with in a malignant form
the river districts of India and China, and all along the shores of the Red
Persian Gulf. Along the western coast of Africa the disease is of the
nt type. In fact, nearly the whole of known Africa abounds in
poison. In America the malarious influence is wide-spread. In
form it is found in the Southern States, especially those bordering
e Gulf of Mexico. There is no one whole State in the United States
ompletely exempt from the disorder. Many localities are known to
y malarious, while regions bordering upon it may be entirely free from
onous influence. Perhaps the New England States are as nearly ex-
any equally large section of the country.

te is known to have a controlling influence over the development of
ma, and perhaps heat has as much to do with its propagation as any
iatic agency. Still heat is not sufficient alone to develop the specific

In all regions of country where drainage is insufficient, the ground
w and marshy, we expect to find the malarious diseases most severe.
y be expected especially near the sea coast where salt water enters
marshy formation. Bottom lands, subject to frequent overflow also
alaria, and sometimes from the action of the sun's heat upon the moist
effect is more deleterious than from a marsh itself. For this same
ities and towns have been suddenly infected when extensive sewerage
ng operations were in progress. Frequently a hot, dry summer is as
ive of the disease as one that is hot and wet. The reason is apparent.
treams which during the usual season do not become dry are entirely
, and their bottoms, reeking with the miasmatic poison, are exposed
owerful heat of the sun and the legitimate results follow.

wo great causative agents for these forms of disease are heat and moist-
ng upon decaying vegetable matter. In those localities where these
ors come together, there will be found the result in the propagation of

Most writers consider that it is scarcely ever developed at a lower
ure than 60 deg. Fahr., and that its development is checked by a tem-
of 32 deg. Fahr. We would not be understood to mean that heat and
e produce the malarial poison. Such is not the case. What the na-
the specific poison may be we are totally ignorant. The fact, however,
that wherever vegetable decomposition is going on with the requisite
of heat and moisture, there we will have malaria.

certain, also, that a given quantity of moisture is as necessary to veg-
ecomposition or growth as a given temperature, and that the extrica
he paludal poison will be most abundant from that soil which contains
moisture than is necessary for that process; for an excess in quantity,
ling and separating the particles, and by preventing the access of at-
ric air, will either retard or altogether put a stop to putrescency. Hence
countries frequent and heavy rains will render marsh fevers prevalent,
rating the whole of the open country; while privation of rain will in
oduce exactly the same effect in other instances, merely by diminish-
superfluous quantity of water. Thus, in the West Indias, an uncom-
ainy season seldom fails, in the perfectly dry and well cleared Island of
oes, to induce for a time general sickness: while at Trinidad, whose cen-
tions are described as a sea of swamp, and where it rains nine months
ear, an excess of moisture is a preservative from sickness; for should at
rains fall only eight months in the year, instead of nine, the swamps
y and bared to the sun, and remittent fevers of the worst kind are

sure to make their appearance. The same result follows on the subsiding of the waters of rivers that have overflowed their banks, as those of the Nile, the Rhone, the Danube, the Tigris, the Ganges, and many others." (Aitken, Science and practice of Medicine, Vol. I. P 861.)

It is impossible to derive any exact knowledge of the existence of the malarial influence in any locality by the comparison of statistics as given in the census of 1870. There are circumscribed neighborhoods in many portions of the country, where from local circumstances malaria may abound to a high degree, and yet the figures show but a small rate of mortality when taken from the State at large. However, as an aproximation, they may be valuable, as in the main they will be found to represent the relative frequency of the diseases occurring in the States or Territories mentioned.

Table showing the localities where malaria abounds:

State or Territory.	Deaths from all causes to one death from intermittent or remittent fever.	State or Territory	Deaths from all causes to one death from intermittent or remittent fever
1 Florida	10.6	7 Louisiana	17.3
2 Texas, west of the Colorado river	10.9	8 Kansas	18.9
3 Texas, east of the Colorado river	12.5	9 Georgia	19.3
4 Arkansas	13.9	10 South Carolina	20.1
5 Alabama	14.3	11 North Carolina	23.8
6 Mississippi	14.5	12 Tennessee	24.9

The whole number of deaths in the United States during the year 1870 from remittent and intermittent fevers, was 11,423, or one death in 43.1 deaths from all causes.

Those localities in which malarial poison is less frequently developed, is shown by the following table:—[Ninth Census reports.]

States aud Territories.	Deaths from all causes to one death from intermittent and remittent fevers.	States and Territories.	Deaths from all causes to one death from intermittent and remittent fevers.
1 Massachusetts	410.5	7 New Hampshire	204.3
2 Rhode Island	391.6	8 Maine	198.2
3 Vermont	272.7	9 Wisconsin	177.9
4 Connecticut	242.7	10 New York	158.9
5 Minnesota	234.1	11 West Virginia	148.8
6 Pennsylvania	210.6	12 New Jersey	137.5

[TO BE CONTINUED.]

BIRDS OBSERVED DURING A FEW HOURS STROLL ABOUT WILMINGTON, N. C.

BY C. J. MAYNARD.

On May 25th, 1872, I chanced to be in Wilmington, N. C., delayed for a few hours, being homeward bound from Florida. It was while wandering about the streets and suburbs of this pleasantly situated city that I observed the birds given below, and knowing that all local lists, however brief, are useful, I carefully noticed them down with such facts as I thought interesting.

Wilmington is built on the Cape Fear river. The land is rolling, the hills

of considerable elevation for this section. The streets are like those of all Southern cities, well sheltered by live oaks and many other species of trees. The first birds that attracted my ottention were the Orchard *cterus Spurous*,) which were searching among the tree-tops for in- were very abundant, and the entire city was echoing with their songs. They were building their nests thus early in the season. of the houses in the city have accompanying gardens filled with shrub- ch was then covered with beautiful flowers. These pleasant retreats me homes of a large number of Yellow Warblers, (*Dendroica æstivia*,) notes of which reminded me of the hedges of New England, for the equally common in both places. The harsh notes of the Mocking *imus polyglottis*) were occasionally heard in these gardens. They reeding, and several boys whom I met informed me that they knew of three nests containing eggs.

familiar though homely note of the Cat Bird was also to be heard com- n the thickets which occupied waste places in garden corners. They, re evidently breeding.

rinkling of Chipping Sparrows (*Spizella socialis*) were giving their odd ies for songs while perched on some convenient angle of a stone top of a gate close by the sidewalks. I observed some of these little having some of the usual spring accompaniment of a bunch of horse or, rather, this being the South, mule hairs) projecting from their tiny bills, so concluded that somewhere among the light green leaves of the orange, were hidden partly completed nests.

n coming out of the streets of the more thickly populated part of the city e sandy roads of the suburbs, I found the place was nearly surrounded elt of what we call in Florida "Scrub," composed mainly of a low growth rf oaks. While passing this I heard the "cow cow" of some species of o, and immediately a Yellow bill *cocygus Americanus* darted across the

w, warbling note on the margin of the scrub called my attention toward ainted Buntings (*Cianospiria ciris.*) The male, in brilliant, fully adult ge, was chasing the female playfully about, occasionally pausing to sing o notes which I had first heard. Thinking that they might have a nest approached, but, as is the custom of this species, they took alarm upon me and instantly disappeared.

erging from the bushes I found myself in the open, piny woods. Here ed in amazement for I heard a note which surprised me much. This other than that of Bachman's Finch, a bird which had hitherto not ound north of Georgia. They were quite abundant; the males being d on the dead lower limbs of the huge pines, singing, while I flushed the s from the grass which covered the ground. Their notes were the same, e plumage was, as far as I could see, identical with that of specimens I had taken but a few days before on Lake Harney, in Florida.

ile looking at the Finches, a small flock of Blue Birds came straggling accompanied by a few of those odd little birds, the Brown-headed Nut- es. The companionship of these two widely different species, although ar, is of quite common occurrence. In Florida I have seen them together times, accompanied by warblers, and even woodpeckers. Indeed the Pileated Woodpecker himself is quite frequently found in this motly com-

I turned to retrace my steps a pair or two of the Partridges of the Quail North,) (*Ortyx Virginianus*) rose lazily, after the manner of this

species when about to breed, and after flying a few paces, dropped and concealed themselves in some low bushes.

A Wood Pewee sat on a low limb of a pine near the road, singing so low that I could scarcely hear him. No doubt he was a migrant practicing the lay which he gives so plaintively yet so distinctly in the cool shades of the echoing groves of the North. I have noticed that spring birds seldom sing their full song at once after the long silence of winter, but practice, as it were. Thus, in Massachusetts, the Tree and Fox-colored Sparrows seldom, if ever, sing their full song. The Bobolinks, as they hasten across the Gulf of Mexico, bound North, are silent, except the metalic-like "clink, clink." When well on the mainland of Florida, they give a few fragmentary snatches of the frolicsome song with which they gladen the meadows of the New England homestead. So in Florida the Wood Pewee is silent, but I heard him practicing at Wilmington.

A few steps further on I passed a small, swampy spot, from which issued the singularly abrupt and and disjointed notes of the White-eyed Vireo (*Vireo novebo ranencis.*) Somewhere further on in the city, I saw a single specimen of another Viero, the Warbling (*Vireo gilvus*)

Upon nearing my hotel on the hill, I found that quite a large flock of Purple Grackles, containing, I will venture to say, nearly all of Mr. Ridgeway's varieties, had taken possession of the trees near, and were endeavoring to add with their discordant voices to the harmony produced by the Orioles.

A few Crows (*Corvus Americanus*) moving over, together with some rapidly flying Chimney Swifts, I was going to say, completed the list; but I had nearly forgotten the ever present Scavenger of the South, the Black Buzzard, which, with widely extended wings, were performing some fine aerial evolutions over head.

This completed an interesting though small list of 19 species. In an equal space of time, in as favorable a locality in New England, I have found nearly three times as many birds. This is merely an example of the paucity of birds during the season of incubation in the South as compared with that of the North. In middle Florida, where I had recently been, they were even more scarce, for aside from a few Herons, it was difficult to find a dozen species of birds in an entire day.

RAIN FALL AND SOLAR SPOTS.

Of late there has been some interest shown in the supposed relation between the periodicity of rain fall and the periodicity of solar spots. The researches of scientists seem to show that there is a very close connection between solar disturbances and terrestrial phenomena, a marked correspondence is observed between magnetic and electric disturbances on the earth and the occurrence of spots on the sun. A periodicity of cyclones in the Indian Ocean is also connected with a similar periodicity of solar spots. A corresponding change of atmospheric temperature and solar spots has also been noted, and it has been found that more rain falls in years of maxima solar spots than in minima solar spot years, showing that here, as well as everywhere else, the sun exerts an influence.

A BED OF CORUNDUM.

valuable bed of corundum has been discovered near the town of Gaylord, county, Michigan. It covers over 25 acres, is from seven to ten feet and is about a half a mile from the Mackinaw division of the Michigan Railroad. This is the material of which emery is made. It is of a une quality, and much better than the imported article.

ARCHÆOLOGICAL.

that there has been organized a State Archæological Society at nio, of which Gen. R. Brinkerhoof was elected President, and nine were elected. It is proposed to hold the next meeting at New- on the first Tuesday of Sept. 1876. This is the first attempt in the tes to form an association of this kind. It is hoped that its success to establish similar societies in the other States.

A NATIONAL ARCHÆOLOGICAL SOCIETY.

s being made to establish a National Archæological Associa- ne purpose of collecting and preserving facts and relics relating to nd pre-historic races of this country. It is proposed to have a convention at Philadelphia during the Centennial Exposition in 1876. movement of great importance, and should have the hearty co-opera- he archiologists of the country.

THE MOUND BUILDERS.

ertains to the history of that ancient and extinct race of men who his country at a time so remote that the traditions of the succeed- an furnish us with absolutely nothing in regard to them, is of the nterest. Although they have disappeared themselves from the face of n, they have left their works scattered over this broad land in great sion. These are in the shape of mounds of earth of various sizes, and , stone forts and other earthen and stone structures. They evidently a race living under a strong and well organized government, at the head ich was a great and powerful ruler, whose will was law. The very name nation has been lost. Hence, from their traces left, they are called the d Builders. These ancient people are supposed to have originated in co or Central America, where long anterior to the discovery of this conti- by Europeans, civilization and arts had attained a degree of perfection by the most advanced people of the Old World. They are sup- have emigrated northward along the coasts and Gulf, and thence over the continent, establishing their cities and towns on such rivers such situations as best suited their interests.

works left by them are very numerous, and many of them extensive and consisting of stone or earthen forts and mounds of various sizes often surmounted by stone or earthen walls, and sometimes sur- by ditches.

enclosing walls frequently had gateways,and gate towers. There are not

less than *ten thousand mounds in Ohio alone.* Some of the mounds are supposed to be erected for observation, others as burial places, containing vaults of stone or wood, in which are found skeletons, with various articles, as beads, arrow heads, pipes, axes, &c.; others seem to be erected for religious rites or for forts. Some are in the shape of birds, quadrupeds, reptiles, or in human form. The inscriptions left on rocks are quite numerous and elaborate.

Although so remote is the epoch of their appearance upon the earth that all facts pertaining to their history are lost, even to their very name, yet long prior to their existence, the earth was peopled by a race of beings of whom nothing remains but a few bones or a few scattered implements. In fact, the researches of scientists have developed the proofs that make it certain that man lived upon the earth at a time far too remote to be embraced in any existing chronology; that he existed cotemporaneous with the great extinct quadrupeds, and in a climate very different from that which now prevails. Pottery has been found buried in deposits that must have taken fully 13,000 years to accumulate.

Foster says: "In the Nile Valley are found the ruins of mighty cities, of crumbling obelisks, and deserted and mouldering temples, which we are accustomed to regard as the oldest of man's work, yet the tread of the men who erected them was above the dust of generations whose name and nation had even then perished from the earth."

In America, also, are found many evidences of the existence of human beings long before the present historic age. Since their advent on this continent great physical and climatological changes have been effected. The great continental glaciers have disappeared, the volcanic peaks of the Sierra Nevada have been lifted up, the great canons have been excavated out of the solid rocks, and where once were rivers are now mountains, the entire face of the country has undergone a change since their advent. From the discovery of relics and crania, buried at great depths, and with animal remains, the advent of man is put as far back as the Miocene and Pliocene.

SAGACITY OF DOGS.

Many interesting incidents have been related of the higher life and forethought of animals, particularly dogs. I will give one which came under my own observation: We obtained a puppy of the "black-and-tan" species. The night being chilly, it was placed with a litter of kittens to sleep, and grew up with them, quite one of the family, but as the animals matured, the dog assumed the mastery, in many ways showing his superiority. Whenever he wished to sit down upon the outside steps he brought one of the kittens, even the old cat was not exempt from the service, and placing it upon the cold step, he would sit upon the warm, living cushion, calmly looking about, apparently quite indifferent to their uncomfortable position. He would never allow them to partake of the food provided for him, though helping himself freely from theirs' when so inclined. After eating what he wished of his own, he would bring, by the nape of their neck, both the old cat and kittens, and place them near his food, when he would disappear around the corner of the house. If any of them ventured to touch his food, he would rush from his hiding place and shake the delinquent violently, putting it back in its place, until it was his sovereign pleasure that they might depart. He continued this until it was very rarely they would venture to touch his food.

CUVIER AND THE SWALLOWS.

'ate years the celebrated Cuvier loved to recount the incident which his attention to the study of natural history. While young and in was engaged as tutor to the children of Count de Hericy, and with nhabited an old chateau in the Pays de Caus at Fiquainville. Cu- ooked towards the garden, and early each morning he was accus- pen his window and breathe the fresh air before commencing the in- f his somewhat undisciplined pupils. One morning he remarked building a nest in the outer angle of his small casement. The brought moist clay in his beak, which the hen, as it were, kneaded nd, with the addition of straws and bits of hay, formed their future he framework completed, both birds hastened to line the inte- eathers, wool and dry leaves; and then, taking flight together into wood, they did not return for several days. Meantime some vents had happened. While the two swallows were so busily em- onstructing their home, Cuvier had remarked two sparrows perched himney who seemed to watch the progress of affairs with The treacherous object of their surveillance speedily became for no sooner had the poor swallows left the coast clear, than the took possession of the nest, and established themselves in as though it had been their own property. Cuvier remarked never absented themselves together from the nest; one always re he watch, with its sturdy bill protruded through the entrance, to exclude every visitor except its mate.

end of the honeymoon the rightful owners returned. What was their o find their nest preoccupied. The cock flew indignantly against his o expell the intruders, but was met by the formidable beak of the which quickly repulsed the unlucky proprietor with a bleeding ruffled feathers. Trembling with rage and shame, and his bright eye ire, he returned to his bride, perched on a green bough, and seemed moments to hold an anxious colloquy with her. Then they took and soon disappeared.

Anon the hen sparrow returned and her husband, as Cuvier conjectured, r an animated account of his adventure, accompanying this recital with curious little cries, which might well pass for derisive laughter. Be it may the prudent pair did not waste much time in chattering, but has- ut in turns to collect and store up a quantity of provisions. This ac- shed they both remained within, and now two stout beaks were placed liness to defend the entrance. Cries resounded in the air; crowds of rs began to assemble on the roof. Cuvier recognized in the midst of he expelled householders making their wrongs known to each fresh ar-

long there were assembled in full conclave upwards of two hundred rs. While they were chattering in a style that fully rivalled the per- ces of many ambitious and celebrated meetings, a cry of distress was from one of the window sills. A young swallow, tired no doubt of the parliamentary debate, had partaken himself to the pursuit of some flies ere buzzing about the window. Cuvier's pupils had placed a snare on l, and the poor bird found one of his slender legs entangled by the cruel hair.

he cry of the captive about twenty of his brethren flew towards him,

and tried to set him free; but in vain. Each effort only served to tighten his bonds, and to increase his pain. Suddenly the swallows as if with one consent took flight, and wheeling into the air, came one by one and gave a sharp peck at the snare, which, after repeated pulls snapped in two and the freed bird flew joyously away with his kind companions. During this scene, which passed within a few yards of Cuvier, and at about the same distance as the usurped nest, the tutor remained motionless, and the sparrows never once stirred their threatening protruded beaks.

Suddenly, and swift as thought, flew a host of swallows against the nest; each had his bill filled with mud, which he discharged against the entrance, and then gave place to another, who repeated the manœvre. This they managed to accomplish while two inches distant from the nest, so as to keep out of reach of the beleagured sparrows. Indeed, the latter were so effectually blinded by the first discharge of mud that they no longer thought of defending themselves. Meantime the swallows continued to heap mud on the nest until it was completely covered; the opening would have been quite chocked up but for the desperate efforts made by the sparrows, who by several conclusive shocks contrived to shake off some of the pellets. But a detachment of the implacable swallows perched on the nest, and with their beaks and claws smoothed and pressed down the tough clay over the opening, and at length succeeded in closing it hermetically. Then were heard from hundreds of little throats cries of vengeance and victory!

But the swallows did not end their work here. They hastened to bring from all directions materials for a second nest, which they constructed over the blocked up entrance of the first one; and two hours after the execution of the sparrows the new nest was inhabited by the ejected swallows.

The inexorable vengeance was now completed. Not only were the unfortunate sparrows doomed to expiate their crime by a lingering death, but they were forced during their torments to listen to the joyful song of the two swallows, the cause of their execution. During many days the hen had rarely quitted the nest; she had laid six eggs, and while she was hatching them, her mate supplied her with insects for food. At the end of a fortnight Cuvier remarked that the cock was busy all day bringing an enormous quantity of insects to his household; and looking into the nest, he saw six little yellow bills all gapping wide for food. From that time it became a constant sort of pleasure to the tutor to watch the progressive development of the little family. Their yellow beaks became black and shining, their downy bodies were covered with smooth and elegant plumage, and they began to accompany their mother in her short excursions from the nest. The cock taught his children how to seize their prey in the air; how to fly high when the atmosphere was calm, and the flies disported themselves in the upper regions; and how to keep near the ground when a storm was approaching; for then all insects seek a shelter.

Thus passed the summer, and autumn came. Crowds of swallows once more assembled on the roof of the Chateau de Fiquinville. They held regular conversations, and Cuvier amused himself with trying to interpret their language. The children of the nest were placed in the midst of the troop with the other young swallows; and one morning the whole assembly took flight simultaneously, and directed their course towards the east. In the spring the two swallows, lean, and with ruffled feathers, came and took possession of the nest. Cuvier immediately recognized them; they were the identical birds whom he had watched with so much interest during the preceding year. They began to repair their dwelling, and to stop the chinks produced by the winter's frost; they relined the interior with soft dried moss and feathers, and then, as in the previous season, set out for an excursion.

The morning after their return, as they were gaily pursuing their prey close

ıvier's window, for now they were quite tame, and accustomed to his pres-
a hawk that was soaring in the air pounced suddenly on the cock. He
k him with his talons, and was bearing him off when Cuvier fired at him
his fowling-piece which happened luckily to be at hand. The brigand
ıto the garden mortally wounded, and Cuvier hastened to relieve his poor
friend. The swallow was seriously wounded; the hawk's talons had
ly pierced his sides, and a grain or two of shot had grazed his breast, and
ɔne wing. The kind young man dressed the wounds with all possible
nd tenderness, and then with the assistance of a ladder, replaced him in
while the poor hen fluttered sadly round the mate, uttering piercing
ıstress. During three days she only quitted the nest to seek for in-
ch she brought to her cock. Cuvier watched his little languishing
eoıy raised to take the offered food, but each day his strength visibly
d. At length early one morning Cuvier was awakened by the cries of
, who was beating her wings against the window; he ran to the nest.
t contained a lifeless body! From that moment the hen drooped and
,way. She never left the nest, refused the food which Cuvier constantly
her, and, literally broken hearted, expired five days a ter the death of
oved companion.

little history left a strong impression on the amiable and gifted mind
young tutor. It led him to devote his leisure hours to the interesting
of natural history; and many months afterwards he related the anecdote
Abbe Tessier, who was paying a visit at the chateau. Revolutionary
ıtion had obliged this distinguished man to take refuge in Normandy,
cept the situation of physician to the hospital of Fecamp. Struck with
dent talent of Cuvier, he engaged him to deliver a course of lectures on
l history to the pupils attending his hospital; and wrote to introduce
the notice of Jessieu and Geoffry-Saint-Hilaire. Cuvier entered into
ɔondence with these and other scientific men; and after some time past
found study he was appointed to fill the chair of comparative anatomy at
The remainder of his glorious career is master of natural history.—*Sentinel*

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have received a pamphlet entitled "A Natural Classification of the Fal-
e," by Robert Ridgway, also, the "Transactions of the Scientific Asso-
ı of Richmond, Ind.," a new and flourishing society organized in April.
also a "Treatise on the Hot Springs of Arkansas," by Algernon S. Gar-
A. M. M. D.

have also received several interesting historical tracts from Col. Chas.
lesy and C. C. Baldwin, of Cleveland, Ohio.

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NO. 2.

The ...tific Monthly.

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...zine Devoted to the Natural Sciences.

E. H. FITCH, Editor and Proprietor.

TOLEDO, OHIO.

NOVEMBER, 1875.——

The Scientific Monthly.

VOL. 1. NO. 2.

PRICE, $3.00 A YEAR IN ADVANCE; OR, 35 CENTS A NUMBER.

All communications, of whatever nature, in regard to the Magazine, should be addressed to E. H. FITCH, Editor and Proprietor, TOLEDO, O.

The columns of the SCIENTIFIC MONTHLY will be freely open for all well written articles on scientific subjects and the candid setting forth of opinions and views on Natural Science.

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Scientific Monthly.

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THE SWALLOW-TAILED KITE.

(*Nauclerus forficatus.*)

Form, swallow-like; body, stout; legs, short and stout; tail and wings, very long—tail, deeply forked. Bill, small—curved from the base; the commissure, faintly sinuated; nostrils, oval—situated at the outer edge of the cere, obliquely vertical, open; cere, very narrow; cutting edges of the lower mandible, very convex—the depth of the lower mandible at its base being only half as much as it is through the middle; gonys, nearly straight—drooping terminally; tarsus, equal to middle toe—covered with large irregular plates; toes, short and stout—the lateral toes of equal length, but the claw on the inside toe the longest; claws, much curved, stout, and grooved on the under side; tarsus, feathered half-way down in front—naked behind to the knee; large plates at base of claws on each toe. Third wing quill longest; first, about equal to fifth. The tarsus is equal to the skull; the tail covers seven-ninths of the closed wing; the tail is half as long as the body (tip of bill to end of longest tail feather;) top curve of bill equal to skull. Two outer primaries, with their inner webs sinuated, secondaries, cover one-half the closed wing. Whole head and neck all round, entire lower parts, lining to the wings, and a broad band across the rump,

pure, silky white. All the upper parts, including the back, interscapulars, lower part of the rump, upper tail coverts, tail and wings, are deep, glossy, metallic black; the tertials are white at the bases; iris, red; bill, black; legs, yellow; claws, white. Length, twenty-four and six-eighth inches; wing, eighteen inches; tail, (outer feather,) fourteen inches; tail, (middle feather,) six inches; carpal joint to end of second aries, nine inches; tarsus, one inch and one-eighth; middle toe, one and one eighth inches—its claw, four-eighth inches; inside toe, six-eighth inches—claw, five-eighth inches; outside toe, seven-eighth inches—claw, three-eighth inches; hind toe, five-eighth inches—its claw, six-eighth inches. (All the claws are measured on the top curve.) The tail extends one inch beyond the ends of the wings; the outer tail feather is eight inches longer than the middle pair; the primaries are obtusely rounded at the ends; the outer tail feathers are rather broad and slightly taper towards the ends, which are rounded; outer tail feather twice as long as the middle pair. Extent of wings, four feet six inches. Male and female alike in color. Outer toe joined to middle toe at first joint by a web.

Few birds have a more graceful and beautiful appearance than this elegant species. Formed by nature for an active life in the air—which seems to be its natural element—It may be aptly styled an inhabitant of the clouds, for it spends nearly all its existence upon the wing, soaring and rapidly chasing its insect prey. The Swallow-tailed Kite inhabits all of South America—from the extreme southern borders of Brazil north to the United States. In the latter country, it is found only during the summer months, where it has been observed as far north as the northern parts of Wisconsin and Minnesota. It appears much more numerous and extends farther north in the Mississippi valley than on the Atlantic coast. Specimens have been seen as far north as New York and Massachusetts, but they are rare and mere stragglers, Pennsylvania being its northern limit on the Atlantic coast. The fact is, that so great are its powers of flight, and its propensity for wandering is so marked, that no distance seems to be too far, or any bounds confine it, but it strays where its inclination directs. It has been observed several times in England and on the continent of Europe, where it undoubtedly strayed across the ocean. It appears to arrive in Louisiana from the south in April, flying in large flocks at a great height, and departs again in September, wintering in South America. The Swallow-tailed Kite seems to be of a social disposition, being frequently observed in large flocks, gamboling in the air or pursuing its prey in company. It sometimes associates with the Mississippi Kite.

The flight of the Swallow-tailed Kite is wonderfully easy, elegant and protracted. It is often seen sailing at an immense height in large circles, with immovable outstretched wings, for hours at a time; at other times it dashes by with the rapidity of lightning in pursuit of its prey, using its long, forked tail, which is broadly spread as a rudder, turning and doubling in all conceivable directions with the greatest ease and rapidity.

It catches its prey by means of its feet, and eats as it flys along without stopping; it also bathes and drinks while flying, dipping into the water as it skims over its surface. All of its motions upon the wing are exceedingly rapid

the sudden turns, deep curves and doublings which it executes are beyond description.

light of this species is made without any direct motion of the wings—to float upon the air, which sometimes gives a rocking motion to their as when the wings are held above the plain of the body. While after food the neck is sometimes seen to slowly and gracefully bend bringing the head under the body; at the same time the foot, with contracted as if holding some game, is brought forward until the bill meet, when the bill is seen to open and close; the head is again brought foot thrown back. This movement is the process by which food is the mouth—the prey being always captured by means of the feet.

never attack other birds or quadrupeds—their food consisting entirely locusts, beetles, wasps, grubs, and other insects, snakes, frogs They spend all of their time during the day on the wing, and on the topmost branches of tall trees.

ground their movements are awkward and ungainly. When wounded, attack, or seek to defend themselves. They are frequently seen a field or prairie like a dog, after their prey.

build their nests in tall trees, generally near some stream, or other water. The nest resembles that of the crow, and is constructed ex- dry twigs and sticks, mixed with long Spanish moss, and lined with leaves, and dry grass. They begin to lay sometime in May. The eggs four to six, greenish-white, with a few irregular dark brown blotches at ge end. They are 1.75 inch long, and 1.56 inch wide; in shape, oval. probably breed wherever found during Summer, and have been found in Illinois, Wisconsin, and all the Gulf States, and as far north on the c coast as North Carolina. Young birds have been seen in the nest as May in North Carolina. Although seemingly so fond of being in the vicinity r, these birds are not found along the sea coast, but apparently shun the of salt water. Many are found along the Alleghany Mountains, and on stern prairies; they are quite common in Texas, and in the southern part ois. They frequently fly among the trees, and catch the insects among nches as they shoot past. They have a plaintive, clear note, or call, but uttered. Both parents sit alternately on the nest.

ch is a brief account of this, the most beautiful of the Kites found in America. Much needs yet to be learned in regard to its habits. In fact, history of almost all our birds is very imperfectly known, and Ornithology said to be yet in its infancy. Naturalists, as a class, are prone to depend her too much upon books and the inspection of dry skins, or cabinet ens, which too frequently resemble the living, moving, being they charac- about as much as a dried mummy does a perfect, healthy human body. he living, breathing, animated world, the green fields and fragrant woods true fields of operation for the student; here the book of Nature is always and ever unfolds new and startling wonders to the admiring gaze of the who is like a man standing upon the verge of a vast ocean, gazing

upon its illimitable bosom, endeavoring to discern what lies beyond the distant horizon, but ever baffled by its great extent. So the student of Nature will ever find something new and constantly varied in form and habits. The world is full of life; every blade of grass, every leaf and drop of water has its curious inhabitants. No one life time is equal to thoroughly investigate *all*, but where there in such abundance and such variety, none need complain of want of material or that the ground has been thoroughly worked up before him.

Nothing can teach the power, wisdom and goodness of the Creator more forcibly than a study of the works of God, as evidenced in the living world around us. Man is placed among and surrounded by these beings, and he can not, if he would, wholly ignore them; and while the earth is clothed in such varied and beautiful colors, and the air filled with such brilliant, graceful and lovely creatures as birds and insects, the incentive is doubly commanding to know more of their habits, structure and properties. Why should we confine our investigations to the closet, and be mere compilers of what has been discovered by those who have preceded us, poring over books, when nature beckons us out to the fresh air, green fields and mossy hillsides, to study her open pages? She, if rightly and impartially interpreted, commits no errors. Honor, fame, and the satisfaction of discovering the truth, and, it may be, some addition to the common stock of knowledge for the benefit of our fellow men, are the rewards of the ardent and faithful student of Nature.

The closet naturalist reasons and argues how things ought to be, instead of going forth to observe how they are in reality. He is liable to be misled and biased by the views and opinions of others. He can not rightly judge of the fitness of things without observing them in their native freedom, untrammeled by any restraint, and free to act out the nature given them by their Creator. We should observe Nature impartially as it is; we should investigate the facts around us, and study the living, moving creatures by which we are surrounded, unspoiled or changed by contact with man. They will unfold to us a glimpse of a grand and wonderful plan, conceived by no human mind, disclosing ideas of all that is beautiful, varied and holy. This profusely and splendidly illustrated volume of the Creator, where the pages speak, move and act for themselves, is ever open. It reveals to us that Nature, the whole Universe, the world and all it contains, the countless multitude of created beings, are all the results of a divine plan. While thus all Nature is beautiful, obeying God's will, and working out his holy plans, they serve a fitting example for the study of man. The starry heavens, the limitless ocean, the varied landscape, the glittering sunbeam, the painted butterfly and the tremulous leaf are all "symbols of a divine idea, scattered before us"* by an unstinted hand, to "arrest our attention, provoke our curiosity, and arouse the powers of our mind to contemplation,"* and draw us from the things created to the Creator himself. All that is symmetrical, beautiful and grand is thus unfolded to our admiring gaze, in countless abundance and unstinted variety, and teaching lessons of goodness, beauty and love.

*Winchell. Sketches of Creation.

NFLUENCE OF CLIMATE IN THE DISTRIBUTION OF DISEASE.

[*Continued from last Number.*]

BY W. C. CHAPMAN, M. D.

The forms of disease which we have heretofore considered, are such as are endemic, or at frequent intervals become epidemic, in the United States to a great degree, upon certain meteorological conditions for their gation and development. Besides these there are other diseases, which ll known and greatly dreaded, on account of the frightful mortality that marks their course through a country invaded by them. Prominently e mentioned the *Plague*, *Yellow Fever*, and *Cholera*. As certain climatic ices are to a greater or less extent necessary for their existence, the ing pages will be given to a brief consideration of the influence which e may exert in the distribution of these three forms of disease.

PLAGUE.—In former times there was no disease more terrible in its ravages he plague. The mortality which attended it was greater than from any disease, fully one-half of those attacked dying, during some epidemics. lifficult to say where the disease first presented itself. According to some s, the ancient Egyptians recognized it, and described its peculiar characics. It is impossible to derive any reliable information in regard to its y, until after its appearance in Europe, during the sixth century. During eign of Justinian, an epidemic broke out in Constantinople, which was the nvasion of Europe by the disease, and the first opportunity given for a of its symptoms, course and duration. "The disease from that period prevailed at short intervals in various parts of Europe, as late as the iteenth century." Sir Gilbert Blane has calculated there were no less than -five epidemics of plague in the seventeenth century. Fourteen of these rred in Holland, imported, it is supposed, by the Dutch engaged in the nt trade, about the year 1612, and twelve in England, imported, as has supposed, from Holland. The last epidemic of plague which prevailed in of these countries, was in 1665, the year before the memorable fire of lon. This epidemic was termed the "Great Plague," and spread "with intolerable infection," that 7,165 persons are said to have died in one , while in one year no less than 68,526 died in the city of London and its irbs alone; an immense mortality, considering the then comparatively small unt of population."—(*Aitken*, vol. 1, p. 580.)

Since the seventeenth century the plague epidemic has become gradually and less frequent in Europe, and at the present time the disease is limited a small geographical range, including Egypt and Syria; these countries, ever, have been nearly exempt from the disease for the last quarter of a tury, and if it were not for the occurrence of comparatively slight epidemics

of plague in various portions of Asia and Africa, the disease would be considered as a thing of the past. The United States or Western Continent has never been invaded by it "In the present century plague epidemics have occurred principally in Southeastern Europe, and particularly in the countries bordering on the Lower Danube and the Black Sea, and also in the Balkan peninsula, all these places having been repeatedly visited during the second and third decades. In more western European countries, epidemics have occurred in only three places, viz.: In Malta, (1813), in Noja, in lower Italy, (1815), and in Majorca, (1820). Since 1841 Europe has remained free from the plague, and since 1843 it has not even occurred in Asiatic Turkey, nor in Egypt since 1844. It seemed for a long time as if the plague had entirely disappeared from the earth; during the last decade, however, unmistakable epidemics of the disease, though of comparatively limited extent, have appeared in isolated regions of Africa and Asia. In 1858 and 1859, an epidemic of bubo plague occurred among the Arabs in the vicinity of Benghasi, in North Africa, another in 1857, in Mesopotamia, and one in 1871, in Persian Kurdistan."—(*Ziemssens Cyclopædia*, vol. 1, p. 466.

It is considered by most authorities that Egypt is the only country where plague may be believed to be endemic. It was a popular idea that the disease eminated from dead human bodies, and that therefore the introduction of the rite of burial, in place of the embalming process employed by the ancient Egyptians, was the means of originating the disease, and that fresh outbreaks occurred whenever graves were re-opened. It became, therefore, a capital offence to re-open a grave; protection against such an act was attempted by frequently surrounding the places of burial with walls.*

Of the three diseases we propose to consider, the plague is the least influenced by season or climate. It is a fact that regions located in the tropics have never as yet been visited by the disease, and when it has occurred in an epidemic form, has always selected the temperate zone for its incursions. Most of the European epidemics have occurred in their greatest intensity before the heat of summer, and extreme warm temperature has been known to have a modifying effect. The climate of Egypt is notably mild and dry, the temperature ranging from 32 degrees to 85 degrees, Fahr. The most remarkable peculiarity being the absence of rain-falls, the land being irrigated by the periodic overflow of the river Nile. Liebermeister says:* "The *season of the year* and *the climate* have only a very slight influence, and yet moderate warmth, in connection with dampness, seems to be quite favorable to the propagation of the disease. Most of the epidemics in European Turkey have occurred in the spring and in the beginning of summer. On the other hand, severely cold weather or very dry heat, does not seem to hinder the spreading of the disease, although they exercise a considerable influence in diminishing it. In Cairo, the epidemics generally ceased on the commencement of intense summer heat; in

*Liebermeister, Ziemssens Cyclopædia, vol. 1, p. 471.

and particularly in countries with a tropical climate, the plague has not its appearance. Dampness, and particularly a thoroughly wet soil, are to the dissemination of the disease, and many elevated and dry have enjoyed complete immunity from it."

We conclude from all the facts presented by the various writers we have been to consult, that the plague is a disease propagated by dampness, filth, over- and decomposing animal and vegetable matter, specific in character, climate has a controlling influence, to only a slight degree, over its and dissemination. As with other diseases, depending upon a specific their development, the primary cause of the plague still remains on and may be lighted up at any time. It is at all times endemic in but why this limited geographical range should be allotted to it, has not explained by any known existing meteorological conditions.

FEVER.—In speaking of yellow fever, we would not consider those disease which have some peculiarities in common, with the true pesti- fever, yet differ in so many ways, the one from the other, both in and symptoms, that they cannot be considered the same disease. the various remittent fevers, especially the so-called malarious yellow Mexico, and the West India Islands. True yellow fever is a specific fever, contagious in character, and attended with a yellowness of the conjunctiva, and other peculiarities not necessary to mention here. in which the disease originated is unknown, but as the plague has in Egypt, from whence it radiates to regions beyond its own borders, fever appears to have originated in the West Indies, although in our endemic in Mexico and the southern portions of the United States, of the western coast of Africa.

nature of the special cause of yellow fever is unknown — just as the germs of all other infectious and contagious diseases have not as yet We know, however, that external circumstances exert a con- influence over its development. It is a fact that it is a disease which is to prevail as an epidemic in cities and towns than in the surround- itry, and that seaports are much more liable to be invaded than those situated in the interior. In every epidemic the portions of the city lying the water are the first to be attacked. Frequently the disease makes its on ship-board when the vessel had been near the coasts where the was prevailing. "In some rare instances it has occurred in vessels, the operation of external agencies or the introduction of contagious In 1799 the frigate *General Greene* left Newport for Havana. Before port, yellow fever appeared on board, although Havana, at that time, from the disease. When occurring thus, in a majority of cases, it in the vicinity of the pumps and the main hatchways, where the shell of is most dependent, where consequently there is the greatest amount of and moisture."—(*Metcalf—Essays Sanitary Commission.*)

The geographical range of yellow fever is limited, being dependent upon certain meteorological conditions for its development. "It is limited to very definite geographical limits, never having been known to propagate beyond 48 degrees north latitude, nor without a temperature of 72 degrees Fahr., at least." —(*Aitken.*) "Up to the present time epidemics of yellow fever have been observed between 43 degrees N. and 33 degrees S. latitude in the western hemisphere, and between 42 degrees N. and 8 degress S. in the eastern."—(*Haenisch Ziemssens' Cyclopædia*, vol. 1, p. 489.)

It will be noticed that the zone which is bounded by the degrees of latitude mentioned above includes those portions of the globe which lie in the tropics, and those regions bordering upon the tropics. It is obvious that temperature should be considered as one of the principal agents for propagation of the yellow fever poison. When the disease occurs in other than tropical regions, the portions of the year in which it prevails are the hottest months of summer. "In the United States, we most commonly meet with the early cases during the months of July or August. The disease is prone to last until the first hard frost. During twenty-one successive years, in New Orleans, the extreme limits between the arrival and departure of yellow fever were the twenty-third of May and the last day of December."—(*Metcalf.*)

"The mean temperature of the year must reach at least 72 degrees or 77 degrees Fahr.; such a temperature, in fact, as is always observed in the tropics, especially in the Antilles. It is indeed maintained by Griesinger that the temperature must be uniformly hot for a considerable time (80 Fahr.); but this is denied by West India physicians, who have very often seen a sudden fall of the temperature, within definite limits of course, immediately precede the outbreak of an epidemic. Should the temperature fall considerably during the prevalence of an epidemic, or should a ship on which the disease is raging reach colder latitudes, an abatement is at once observed; and on the occurrence of frost, an immediate extinction of the epidemic."—(*Haenisch.*)

That heat is not the only agent necessary for the development of yellow fever is proven, in the fact, that epidemics of the disease do not occur during every hot season, in those countries in which it is endemic. In many cases moisture in connection with an elevated temperature may be considered as favoring the development of the disease. This may be explained by the fact that in the putrefaction of either animal or vegetable substances, we have one of the chief causes for all miasmatic diseases. Yellow fever being recognized as belonging to this class, is propagated by a specific germ developed during such putrefaction. The fact that yellow fever is more properly a disease of cities also points to this as a principle agent in its causation. By drainage, removal of filth and other sanitary measures, a comparative immunity from the disease may be enjoyed by those living in localities predisposed to the disease. A notable instance of the benefit derived from a proper attention to sanitary regulation, was the freedom from the disease enjoyed by the city of New Orleans during the late war. "All the physical conditions that are supposed to

ote the prevalence of yellow fever — excepting only such as are immedi-
controllable by a sanitary police — prevailed continually and in unusual
in the delta of the Mississippi during this period of immunity from that
se."—(*U. S. Sanitary Commission Memoirs.*)

Previous to the war the annual average of yellow fever victims in New
ns was about 1,000. The average annual death rate, from all causes, from
1861, was six and a half per cent. There were years when the death
:en per cent. These summers (1862–63–64–65) passed without a
/ellow fever epidemic. Besides the observance of a rigid quarantine,
anitary regulations were enforced by the military government, and
is to be ascribed the exemption. The thorough cleansing of the towns
nnah and Charleston, after their occupation by the United States troops,
rigorous sanitary regulations maintained, together with a *military* quar-
have kept them, it is believed, from an outbreak of yellow fever since
—(*Aitken.*)

:itude has been regarded as furnishing immunity from yellow fever
ics. It is known that the disease very rarely occurs at an elevation
than 2,500 feet, although it has been known to have appeared at as great
ude as 4,000 feet. We doubt whether altitude in itself has anything to
1 either arresting or causing the disease, but would consider that the
es cited where it occurred in the island of Jamaica at the height of 4,000
es to prove that, although not endemic to high altitudes yet it may be
by mercantile communication from the lower levels below, and develop
becomes epidemic in character. In the words of Haenisch, "We must
with Hirsch that the absence of maritime commerce in mountainous
s, as it would there be impossible, furnishes the explanation of this dif-
e, since such commerce exists in level though elevated plains, provided
re traversed by rivers which may serve as the means of carrying it on.
ict that yellow fever has repeatedly appeared at elevations of 2,500 feet,
/en 4,000 feet above the level of the sea, is in accordance with this expla-
.."—(*Ziemssens' Cyclopædia*, vol. 1, p. 491.)

:HOLERA. — The very name of this dreadful disease conveys the idea of
and disaster to the minds of all. There is certainly no one scourge that
:e dreaded than this, and in reality there is none that marks its course
gh the countries of the earth with as frightful a rate of mortality. Cholera
ntioned by our oldest authorities — not under that generic name, but the
iptions given show clearly that the disease was identical with the cholera
ire modern times. All authorities agree that the lowlands of India, especi-
the mouths of the great rivers, are at all times the centers of departure
whence radiates the epidemic influence. In this region cholera is at all
endemic; so much is this the case, that *Cholera Indica* or *Asiatica* is the
by which it is known throughout the globe. The first mention of this dis-
found in the writings of Sonnerat as occurring in Pondicherry in 1768–71

which destroyed 60,000 lives.* The first epidemic of cholera which is known to have extended beyond its proper boundaries originated in Jessora, a city some distance from Calcutta, in the year 1817. "On August 19, 1817, Dr. Robert Tytler, of Jessora, a city some forty hours northeast of Calcutta, was called by an Indian physician to a patient who had been seized in the night with violent vomiting and diarrhœa. The patient was moribund, and the English physician was about to make up the case in his report as one of poisoning, when he learned that some seventeen other cases had been attacked at the same time and had quickly died. So rapidly now did this epidemic spread that more than 10,000 inhabitants of Jessora and vicinity fell victims in the next two months. This was the first commencement of that fearful epidemic which has now for years spread sorrow and desolation over almost all the lands of earth." —(*Lebert—Ziemssens' Cyclopædia*, vol. 1, p. 353.)

From this point of departure the disease invaded the whole of India, so that during the first year the number of deaths is stated as 600,000. By the year 1820 several cities of China were infected and in three or four years thereafter the whole of southern Asia had been visited. After this date the disease seemed to abate for a short time, to be again renewed with greater activity. Europe had not yet been invaded, but was waiting with dreadful suspense, fearing that it might pass over its boundaries and carry death and disaster to the homes of the most enlightened nations. It was not until the year 1830 that this fear was realized: during this year the Caucasian mountains, which had heretofore appeared to form a barrier to its progress, were overcome and an onward march was made into European Russia. Prussia was entered from the direction of Russia and gradually the whole of Russia was invaded. It crossed the Atlantic ocean and appeared on the Western continent during the summer of 1832, occurring simultaneously in Canada, New York and Pennsylvania; from these points it spread over the greater portion of the United States and Mexico. From Mexico it jumped across the Atlantic ocean and appeared in Portugal and Spain with great violence. In 1835–36 it appeared in Italy and Northern Africa, and seemed to be returning to its point of departure, India. In 1847 it began its march, again starting from India, and again appeared nearly everywhere. The United States was invaded during the year 1849, having entered this country at the north and south at the same time, about the close of the year 1848. This second epidemic had not exhausted itself before it again appeared in Persia in 1850; again spread over the Eastern Continent, appearing in England in 1853. Reaching the Western Continent during the year 1850, it spread over considerable portions of the United States during the years 1853–54. The United States suffered a slight epidemic of the disease during the year 1866. The same was noticed in Europe, and during the German-Austrian war many soldiers were killed by the disease. This year, however, there was no such epidemic influence as was present during the frightful extension of the

*Lebert—Ziemssens' Cyclopædia, vol. 1, p. 353.

n the former years. Since 1866 the cholera has not scourged the earth. imes we hear of the disease as epidemic in India, and it has appeared in various parts of the globe, as during the year 1873 it presented n the southern and middle portions of our own country. It is to be hat we shall no more be obliged to record its wide-spread ravages; but rdly possible that the same influences which caused its dissemination, t at some future time again start it on its march of destruction.*

olera is a disease depending upon a specific cause for its origin, and, as e said, existing at all seasons of the year in India as an endemic disease. stion arises as to the causes which may exert an influence in its propaga- d especially the climatic influences which may be considered as favorable lissemination.

AITKIN, speaking of circumstances which may assist in spreading the poison, considers them under two heads: firstly, "*Meteorological Conditi*- secondly, "*Localizing Causes.*" As this classification cannot be out in as brief a presentation of the subject as the limits of this allow, they will be presented together. These agencies may be men- the headings of *temperature*, *humidity*, *atmospheric pressure*, *condition* and *altitude*.

a fact that as a rule cholera epidemics occur during the warmer season ear, and that the approach of winter causes a decline in the epidemic "Dr. Macnamara states generally that the disease is most active thermometer stands at from 70 deg Fahr. to 80 deg. Fahr., or even Fahr. in India, rising in the sun to 120 deg. Fahr., and upward."

the epidemic of 1866 in London the temperature was notably high. nean temperature of the week ending the 30th of June, in which the cases of cholera occurred, was 48 deg. above the mean of the same week erage of fifty years. During the next week the mean temperature fell below this average; but in the following week the mean was in excess In the first third of these weeks the range of temperature was 24.0 in the second 17.5 deg. It is not improbable that the great range of n the last week of June and the second week of July was influen- ome extent in causing the sudden development of the epidemic in other than the east of London during the third and fourth weeks of July and of August. The relationship here suggested between the temperature development of the epidemic in the districts referred to, is supported correspondence between the lagging of the epidemic during its decline, sudden elevations of the temperature above the mean. The rate of of the outbreak was much slower after the third week of fall than in s epidemics. The epidemic lagged, in fact, and this lagging first followed

main facts above presented have been learned from the able article of Prof. Liebert, published in yclopædia of Medicine, vol 1.

and partly accompanied a three weeks elevation of the mean temperature slightly above the average, after a four weeks persistent fall beneath it. And it may be here observed that of the four weeks during which the mortality of the outbreak was greatest, and in each of which the temperature fell below the average, two of the weeks were weeks of rapid decline of the disease. An augmentation of the outbreak in the last week of September and first and second weeks of August, during which the mortality in the metropolis, exclusive of the East District, reached its maximum, occurred cotemporaneously with a three weeks' elevation of the temperature above the average; and the subsequent fall of the epidemic, near the commencement of winter, cotemporaneously with a temperature maintained above the average, was sluggish. Among the facts about cholera in India, none are more clearly made out than the prevalence in different places at particular seasons. It is very plainly influenced most by the combination of influences known as season."—(*Aitken*, vol. 1, p. 625.)

HIRSCH, in an analysis of 341 epidemics in different lands, comes to the conclusion "that cholera has appeared in nearly half of all the epidemics during summer, and chiefly in July and August; that autumn and spring are about alike, but that winter is characterized by a remarkable exemption from the disease. The mortality from cholera in the larger countries in individual seasons, as in England during the cholera years of 1832 and in 1849, is in perfect harmony with this statement."—(*Lebert.*)

An apparent exception to this rule was seen in Russia during the year 1830, when the thermometer ranged from —40 to —20 deg. Fahr. the disease raged as an epidemic in that country. An explanation of this may be that the population living in-doors, by artificial heat supplied the lack of that of the sun, and by other measures, as by filth engendered by over-crowding and the meager supply of pure water, kept alive the germ of disease, which would otherwise have been held in abeyance until the heat of summer.

The fact that the cholera germ is not destroyed by cold, but only remains comparatively inactive during the winter months, is shown in the fact that the various epidemics of cholera diminish in virulence as that season approaches, to be revived again during the hot weather of the following summer.

The condition of the soil and the atmosphere certainly has considerable to do with the propagation of the cholera poison. PETTENKOFER, of Munich, maintains that certain conditions of the soil are necessary for the spread of the epidemic influence of cholera. That the choleraic germ having found its way into a peculiar character of soil is there developed and propagated, so that those who dwell thereon are contaminated by the poison eminating therefrom. In order to favor such a development the soil must possess a certain degree of "*humectation*," regulated by the position of the stratum of subsoil water in reference to the surface. That such condition of soil is a means of dissemination of the miasm no one doubts, but there are other means whereby it is propagated, and perhaps many which are more active than this. The germs of the disease need not pass into the earth primarily, but may be multiplied in whatever position

may receive a proper degree of heat and moisture. Thus vaults, and cess- and sewers become fruitful sources from whence the poison eminates in epidemic. Even well-water has been frequently known to convey poison to communities drinking from them.

There is considerable variation as regards the influence of rain falls upon disease. "In Europe all the great epidemics have ocurred in times of pro- drought; and the dissemination or dispersion of the disease is very related to rain-fall, as Dr. W. BUDD, of Bristol, has shown. By diluting ison, and by giving rise to floods which sweep it beyond the inhabited ain seems to have a powerful influence in checking the disease. But to his effect the rain-fall must be heavy and continuous; while on the con- ight and intermittent rains favor its spread."—(*Aitken.*)

In India, according to PETTENKOFER, the development of cholera demands ium degree of humidity of the soil. Great and protracted dryness, as well as ive, long-continued moisture of the soil, are alike unfavorable to cholera; ore it is that in the hot regions of the East Indies, where the dryness pre- ates and rain-falls are scanty, the cholera breaks out, as a rule, in the season (the summer or monsoon cholera of Lahore); while in the hot s of lower Bengal, where wet weather predominates and rain-falls are lant, the cholera prevails in spring seasons which lack their usual rains, g cholera of Calcutta,) and are dissipated again by the summer or mon- rains. Places like Madras, which stand midway between Lahore and tta, as regards rain-falls, other circumstances being just the same, show r regularly a spring and summer cholera in the same locality."—(*Lebert.*)

t has been remarked by many writers that there is noticed a very oppres- condition of the atmosphere during the rage of a cholera epidemic. This has ently been noticed, and also the difficulty with which proper ventilation of ings is carried on. This condition of the atmosphere does not always prevail, hen it is present, is supposed to be occasioned by a certain deficiency of ricity, and, as some claim, an absence of ozone. During the epidemic of in London, Mr. Glaisher writes: "The air was in almost constant motion, iently blowing a much heavier gale than usual at this season of the year." ne epidemic, that of 1866, Mr. Glaisher reports a peculiar condition of the sphere. He says: "One of the most remarkable atmospheric phenomena ng the past quarter, has been the prevalence of a peculiar blue mist, first by myself on the 30th of July, but which had been remarked by other in the preceding week. This blue mist, since that time, has been present. On some days no trace of the mist has been visible, and on days it has been seen for parts of a day only. It has extended from to the Isle of Wight, and of the same tint of blue everywhere. This n intensity when viewed through a telescope; usually no mist seen when thus viewed: it increased in density during the fall of rain; mist rises after the fall of rain. Its density did not decrease when the was blowing moderately strong, but did decrease when a gale was blowing,

but increased again on its subsidence. I do not know the nature of this blue influence; but the fact of its presence not having been noticed since the cholera period of 1854 till now, points out a possible connection; but independently of this, it is of high meteorological interest."—(*Aitken.*)

Elevation cannot be considered as having much, if any, relation with the occurrence of cholera, although the disease prevails more frequently in lowlands than upon elevated positions. This may be accounted for, by the tendency to miasmatic diseases, as found in all countries lying near the sea level. In many regions it would appear as if the disease could not leap over elevated mountain ranges, while at other times localities have been visited at great altitudes, as at Bogota, in 1849,—9,000 feet above the level of the sea; at Emmerich, in Persia, 7,000 feet; several times in the city of Mexico, at an altitude of nearly 8,000 feet, and many other portions of the globe.

It would be profitable if the influence of climate in the distribution of many other diseases than the ones we have described, could be given, but space certainly forbids. We have endeavored to present the diseases which are most commonly met with, that are developed and propagated by climatic influences. In most of them we find, not a cause for the disease in any influence which climate may exert, but their origin being miasmatic in character, the specific germ for each form of disease, requires but the proper surroundings to multiply and spread death and desolation among the inhabitants of earth.

TOLEDO, Sept. 10, 1875.

SAGACITY OF DOGS.

In illustration of the sagacity sometimes exhibited by dogs, we will give the following incidents which fell under the observation of the author: A young lady married, and went to reside nearly two miles from her former home, where there was a small dog, which was in the habit of accompanying the different members of the family upon their visits to the new housekeepers. After a few such visits he finally became accustomed to make the trips alone. He would run out to the front door and wait until a street car came past, when he would jump on and ride to the corner of the street upon which the newly married couple resided, and, jumping off, would make his visit. Then he would leave for home, walking nearly a quarter of a mile to the corner past which the cars ran, and waiting until a return car passed, would jump on and return home. On one or two occasions he could not get out of the car, the door being closed. He would then ride until some one got off, when he would wait for another car, and ride home on the platform. He always after this took care to ride outside, so as to be able to get off when he reached his destination.

Another dog, belonging to a lady who kept a small stick with which she whipped him when unruly, after one of these castigations, went and got the stick, and taking it to a stove, stuck the end into the fire, and continued pushing it in until it was entirely consumed, looking around from time to time, to see if he was observed, when he ran frisking to the lady, manifesting the greatest satisfaction.

ROCK INSCRIPTIONS, AMHERST, LORAIN CO., OHIO.

BY COL. CHARLES WHITTELSEY.

Soon after the publication of our pamphlet (1872) on the stone sculptures at
lence, Cuyahoga county, and at Barnesville, Belmont county, O., Mrs.
OLLINS, of this city, referred us to similar ones at Amherst. In October
ı self-constituted committee of members repaired to the farm of Mr. J. J.
with whom we had been in correspondence, and by whom we were most
ıbly received. He resides about two miles south of the railroad station,
95, where the Berea sandstone, or "grindstone grit," appears as a surface

he exposures here are in the form of flat domes, on which at the center
s no soil: the bare places embracing one or two square rods of surface
On all sides the soil rock passes under a thin, stony soil, on which there
growth of native chestnut and oak trees, of good size. Some of them
)een cut, and among the stumps, grass and bushes cover the ground.
a low ridge, nearly flat, which is in direction nearly north and south,
very little above the surrounding land, there are, in a distance of sixty
ıalf a dozen bare spots, on which there are great numbers of grooves,
)f which have the appearance of artificial work.
Ir. RICE has occupied the land about forty years; but did not nptice these
s until fifteen years since. At that time there were, so-called, "turkey
" on similar rocks, a mile and a half to the east, which are now broken up.
ICE is an intelligent man and has carefully preserved those on his premises.
ıd his partner, Mr. BECKWITH, entered zealously into our designs, and
ed us by clearing the rocks of soil at several places, in a way that greatly
ated our work.
)n one of the bare spots there are forty-five small artificial cavities, from
nch to four inches in diameter, within a space of fifteen feet square. They
ıade with a pick, not formed true and smooth by a revolving tool, like the
haped ones of the "spindle stones." Their depth is quite uniform, being
le less than the radius, and are, therefore, not perfect hemispheres. All
spindle-stone" depressions are of equal size, having a diameter of an inch
)ne-half, with a depth equal to radius. These are of various sizes.
No circular cavities were seen except in this group, and among them were
:her figures. When this rock was uncovered a few feet distant, there was
ł beneath the soil, and beneath the roots and stumps of old trees, elaborate
nels on the surface to which I have referred. Some of them are straight,
)ly-cut grooves, fully as deep as they are broad, and from half an inch to an
wide. Others are curved, having a rounded bottom in the cross section.
y of them are very faint lines, something like artificial markings, parallel
r length. No marks of the pick are visible in them. They cross each
ıll angles, forming a concatenation of straight and curved lines. After

Markings on Sandstone, 12 feet Northwest of the human feet—one-sixth linear.

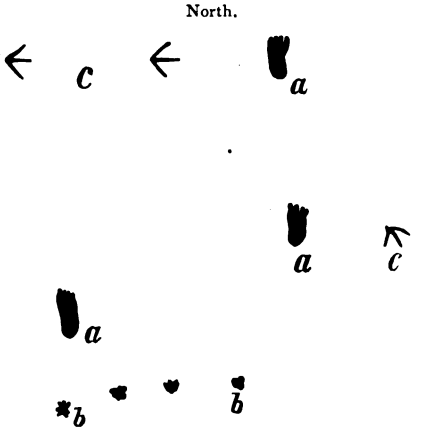
[*Plate A.*]

a portion of them on cloth, we found it difficult to convince ourselves
ney were artificial. One copy reduced by photograph will enable every
to judge for himself. [*See plate A.*] They were found at almost every
where the soil was removed from the rock, but scarcely ever on parts
bare. Their general aspect does not represent the forms of the roots
They do not radiate from centers, nor show any regularity of form.
ots have as yet been found in them. In no other place yet brought to our
, have growing trees absorbed the rock on which they stand to such an
t. On Kelley's Island the soil is quite as thin as it is here, and rests on
ock.

Hundreds of acres have there been planed, grooved and polished, by ancient
l action. The roots of most of the old forest trees penetrated through the
depth of one and two feet, to the rock. In only a few instances has the
been noticeably absorbed or worn away by them. Most of the glaciation
sh, and the light ice lines or "scratches" are seldom obscured. If a com-
ively soft limestone resists the grinding and absorbing action of a network
ots, from the era of the glaciers, to this time, a rock which is nearly pure
and has become famous throughout the northern cities for its durability
ildings, should resist it altogether.

On this rock the finest cut architectural ornaments retain their edges per-
r after an exposure of more than a quarter of a century. Silicious matter
sorbed by growing vegetation much less rapidly than calcareous matter.
ever mechanical action there may be on rocky surfaces, by rubbing, and
ling of the roots of trees, swayed by the winds, should be greater on lime
than upon sandstone. It is incomprehensible how deep, sharp, narrow
nels could be worn into such a rock in this manner. Yet I think any one
may examine those at Amherst, will be equally puzzled in regard to their
cial character.

Twenty rods north of the circular cavi-
above referred to, are effigies of human
and of bird tracks, evidently artificial.
of the feet are deficient one toe, which
t have been omitted by design. About
ve feet northwest of the center of the
p of feet, is a congerie of the mysteri-
figures to which I have referred, and
h are represented in the engraving.
everal other places the channels are
but the figures less satisfactory.
several hours' examination without
able to resolve them into either ani-
pictorial signs, or other effigies, we
d them over a space a few feet across and pressed the cloth upon the fresh
for an impression.



These are a fair sample of a dozen groups along a space of nearly a quarter of a mile, most of them covered with earth and trees, or the stumps of trees. We saw no sculptured human hands or heads, and only one group of feet. Another indistinct foot is said to be there, but we did not find it. Those which are on the rock as above given are in regular marching order, but a part of the foot-prints are wanting.

The rock is so imperishable, that the absent ones would now be found there if they had ever been made.

In the deserts of Sinai, according to Prof. PALMER, when an Arab leaves a message on his trail, for those who are to follow, he makes an impress of his foot upon the sand; the toes point in the direction he is traveling.

In the picture writings of the Aztecs, the human foot is used as a symbol of the same fact. Such symbols are used by the North American Indians, for the same purpose. To him, such tracks show the nation, the tribe, and oftentimes the family, and the individual by whom they are made. They are equivalent to a private seal. There is a difference in the form and style of the foot which is clear to wild men, who study such peculiarities. I have seen a Chippeway on the upper waters of the Mississippi, scrutinizing an old track in the mud with intense interest. It was so nearly obliterated that it was doubtful to me whether it was that of a man or a bear. He soon uttered a startling cry and refused to go with us any further. He knew it to be the foot print of a Sioux, a nation who are hereditary enemies of the Chippeways. We found near by the remains of their lodges and other evidences showing that a war party had been prowling over the border in search of scalps, about three weeks previous. Everything about these nations is so different — their manner of walking, making fires. canoes, lodges, moccasins, or pipes — that they cannot pass into the country of another people without being detected.

INSCRIPTIONS ON THE CLAY BANKS, BAD RIVER, ASHLAND CO., WISCONSIN.

A few representations of these figures are given for the purpose of comparison with the ancient stone inscriptions. A short distance below the portage, across a long, loop-like bend of the Mashkeg or Bad River, about three miles above the Odanah Mission, is a perpendicular bluff of clay, on the west bank of the stream. Steep clay and sand bluffs are common through the flat country below the falls of Bad River. This one has been sheltered by a thick fringe of growing trees from the wearing effects of storms. It presents quite a smooth, upright face of dry clay, that is easily cut with a knife, about 50 feet long and about 10 to 15 feet high. This space is completely covered with picture records, made by the Chippeways. No doubt many of them are old, but most of them have been made recently, or by men now living, often obliterating or cutting new inscriptions over old ones.

It is reported that J. G. KOHL, the celebrated Prussian traveler, made copies of a number of them when he was on Lake Superior in 1854. If he published his sketches I have not seen them; and if not, his subsequent death will probably

their publication. In my explorations on the waters of Bad River, in 1849 and 1860, I passed them repeatedly, but having other objects in only a few sketches. The effigies are grotesque ot animals, canoes, birds, fishes, men, women, trees, objects, animate and inanimate. My Indians and f the half-breed voyageurs professed to be able to hem. They said it was expected that every young he was old enough to become a warrior, should some solitary place and undergo a fast. The time he could do without food, was a test of his Sometimes he perched in a tree day and night, a rock or upon a high mountain, without fire or order to show his contempt of pain and exposure. ne naturally had visions, in which his destiny of life was disclosed. Weak constitutions are fast more than three or four days. When the warrior had satisfied himself that his mission on fully disclosed, he returned to his tribe and was as a man. Their version of this ceremony and its agrees generally with that of Chingnauk to Mr. in 1839, as related in vol. 1, pages 13-14, of his American Indians." The symbols of his destiny put upon record, in such a manner and at as he saw fit; but generally on trees, or rocks, traveled route. In some cases a full statement of or visions, was written out in this pictorial mode, *todem* or " totem " attached. I remember the meanonly one, of which figure No. 2 forms a part. The *nine* branches and a hand (*a*) pointing upward, sighe party making it, had fasted *nine* days.

1

2

3

4

5

s nothing in their customs to prevent other messages being left in Their records include nothing historical in regard to the nations, hiefs. Such matters are perpetuated by repetition from the old to the until every young man is thoroughly crammed. General story telling, recital of their traditions, is the literary life work of an Indian. His s a mental record, transmitted from generation to generation. The of such records is very far from reliable.

1 to 5 inclusive are random copies from a large number of the effigies, not made to a scale, but they are fair representations of pictography.

SOME UNCOMMON ELECTRICAL PHENOMENA.

By the above title we wish to designate such occurrences as are occasionally seen, but are not frequent, as St. Elmo fires, globes of fire, and jack-'o-lanterns. The St. Elmo fire is a slow, quiet, and steady outflow of electricity, which radiates from some prominent point, as the topmost tip of a mast, spire of a church, or flag-pole. It appears as a steady flame, or tuft of light, of a blue or yellow color, about two feet high. They are to be seen during thunder weather, when the terrestrial electricity is attracted strongly by that of the clouds. They are occasionally seen playing over man himself or his clothes, and the bayonets of soldiers have been seen tipped with flames of fire. Although so brilliant, the St. Elmo fire is harmless, and does not destroy or hurt what it is attached to.

Frequently during thunder storms, balls of fire are seen. "In September, 1845, during a violent thunder storm, a house in the village of Salagnac, France, was struck by lightning. A large ball of fire descended the chimney, and rolled across the floor of a room, in which sat a child and three women. No one was hurt. It then rolled out through the centre of the kitchen, passing close to the feet of a young peasant, and disappeared through a crevice in the wall. Its erratic course ended in the pig-sty, the harmless occupant of which it despitefully slew, without setting on fire the straw on which the creature lay." They are accompanied by no noise. At another place, one of these fire balls entered an open window, floated about a room, and finally passed out of a door, without doing any harm. After its departure, a strong smell of sulphur was noted. It was of a brilliant yellow, and about two feet in diameter.

The Will-o'-the-wisp, Jack-o'-lantern, or *Ignes fatui*, is a wandering, shadowy fire, produced by the emanations of phosphurated hydrogen gas, which rises out of places where vegetable or animal substances are in the process of decomposition, such as marshes, manure-heaps, or cemeteries, and become spontaneously ignited, when combined with the oxygen of the atmosphere. They are not produced by electricity, but we include them here as they are often confounded with the St. Elmo fire, and are attributed to the same cause. They have often been looked upon by superstitious or ignorant people, with awe and fear, their vacillating lights being attributed to wandering spirits. They sometimes burst forth suddenly on opening a grave, or turning over a manure-heap. We will give a few incidents of electrical phenomena, the four first being from Lardiner's lectures.

Major Sabine and Captain James Ross, in their first Northern expedition, being in the Greenland seas, during one of the dark nights of those regions, were called up by the officer of the deck to observe an extraordinary appearance ahead of the vessel, and being precisely in her course, appeared a stationary light, resting on the water, and rising to a considerable elevation—every other part of the heavens and the horizon all around the ship, being as

ick as pitch. As there was no known danger in this phenomenon, the course the vessel was not changed. When the ship entered the region of this light, officers and crew looking on with the liveliest interest, the whole vessel was the most elevated parts of the masts and sails, and the minutest of the rigging became visible. The extent of this luminous atmosphere have been 450 yards. When the bow of the ship emerged from it, it ed as if the vessel were suddenly plunged in darkness. There was no ial decrease of illumination. The ship was already at a considerable nce from the luminous region, when it was again visible as a stationary light n.

On the 4th day of November, 1749, in latitude N. 42 deg. 48 min., longitude deg., a few minutes before noon, the sky being unclouded, a globe of bluish naving the appearance of a mill-stone, rolled rapidly along the surface of ea, towards the British ship Montague. At a little distance from the vessel se vertically from the water, and struck the masts with an explosion like of several hundred pieces of artillery, committing much damage to the s and rigging. Five sailors were laid senseless on the deck, one of whom severely burned. The usual effects of lightning were observed. A sul- ous odor was diffused through the ship, and large iron nails torn from ous parts of the vessel, were projected on the deck with such force, that ig pinchers were necessary to draw them out.

On the 2d of July, 1750, at 3 o'clock in the afternoon, being in the church t. Michael, at Dijon, during a storm, I saw appear suddenly between the first pillars of the principal nave, an intensely bright red flame, which was ended in the air at the height of three feet from the floor. This flame lually augmented its volume, until it attained the height of from 12 to 15 . After having risen through several fathoms in a diagonal direction, nearly he height of the organ gallery, it disappeared, with an explosion like the ort of a cannon fired in the church.

In one instance a large globe of fire oscillated for a long time in the air r the village of Steeple Acten, Wiltshire, England, upon which it finally fell, troying the houses upon which it dropped. At another time, several large l very bright and glittering balls of fire were observed to drop from a black ud into the sea, illuminating the whole heavens with a fierce and intense lliancy as they fell. This was in the vicinity of Sussex.

In another instance, given by Lardiner, two gentlemen being in a room gether during a storm, saw a globe of fiercely bright fire, about the size of a sed hand, suddenly appear before them, near a foot distance and about five t above the floor. It was surrounded by a black smoke, yet it glowed and urkled with such intense brightness, that it was painful to look upon. It med to hang suspended for some time in one position, but finally burst with d detonation, resembling the simultaneous discharge of many cannon. A moke filled the whole house, and lights of various colors, and having

many oscillatory motions, played about the room. One of the occupants of the room was severely wounded.

On still another occasion, during a thunder storm, a globe of fire appeared in the open door, where, after remaining suspended in the air stationary for a considerable time, glowing with an intensely bright light, it finally advanced into the centre of the room, where, after again hanging suspended stationary for a time, it finally burst, scattering sparkling drops in all directions, with a loud noise, rattling windows and shaking the house to its foundation. The outlines of this ball of fire were very distinct, and it was perfectly spherical, and about as large as a man's head.

Such are a few extracts, giving the nature of these singular electrical phenomena.

THE INDIAN AND MOUND-BUILDERS COMPARED.

BY COL. CHAS. WHITTLESEY.

In assorting the relics in our collection, I began by putting on one side of the case only those which were taken from mounds at such depth as to leave no doubt they belonged to the builders of the mounds. Those which were, without doubt, implements of the modern Indian were put on the other side. When that was done, a large part of the collection remained unclassified. Most of the stone relics are surface-finds, and without special descriptions, except the townships or county. I anticipated that after those which were *clearly Indian*, and those which were *clearly mound-builders*, were put by themselves, the others might be ranged with one set or the other, by their style, finish, form, or some manifest resemblance. But they ran together so much—the Indian and the mound-builder—that no certain line of separation could be drawn. The two sets are not identical but similar.

A great number of the stone tools and implements, already described by various authors, are equivocal as to their precise position, whether from mounds or the surface. They might, therefore, be of the age of the mounds, or belong to subsequent burials by the red man, or they might be surface relics, belonging to both an ancient and a modern people. While this perplexity was upon me, the work of Mr. Jones on the Southern Indians made its appearance, in which the genuine mound relics connot be clearly separated from those of the tribes that occupied the country some 300 years since: neither can they be separated from those of the mounds of the Ohio Valley. These graduate into the stone implements and ornaments, fabricated by the tribes on the waters of the Lakes three centuries since. In fashioning copper tools, the modern Indian had little success. He is, and probably always was, beneath his Southern kinsman in mechanical skill, taste and industry. He was not equal to the erection of earthworks of great proportions. He had polished stone ornaments and implements from the earliest time, but their elegance of proportion is not as conspicuous as those of the Southern tribes. This difference would naturally follow, as between

who were largely agricultural and permanent, compared with hunters who frequently changing places. The climate of the north, though it gives more vigor, develops what is intellectual and artistical more slowly. The of the stomach are too imperious, and the means of gratifying them too to raise a people in the direction of mental cultivation. They assimi- more with the wild animals upon which they prey. In the milder climate he Gulf States natural food is better and life more easily sustained.

There seems to be a law of development in races that is very singular. In erica we find the most ancient traces of mankind near the equator, spreading thence north and south, towards the poles. As they receded from the ics they assumed greater importance, judging from the ruins they have left. outh America, those of the old Peruvian Stock, in North America, those of Moors and Aztecs, are good examples. Beyond these north and on the h, as the climate becomes more severe, and food more scarce, the early ons were evidently more barbarous, as they are at this time. They resist lization longer, and despise labor nearly in proportion as they find it difficult ive. The extreme heat of the equinoctial regions debilitates the race, and extreme cold of the north dwarfs and debases it. Between the zones of eme climate is a medial region of activity and industry, which tends to raise savage to a better condition. In their earliest and most primitive state, the ics suited the race exactly. As they multiply, the surplus must of necessity grate outward, away from the equator. Those who remain cease to improve, oon reached their limit of improvement and began to deteriorate. The emi- nts to semi-tropical climates also reached their limit of improvement, but until a longer period had elapsed; they also reached a higher state of elopment. Farther away to the north, in the temperate zone, the development till higher, covering our modern civilization, which, being slower, should be re durable than that of the north tropics, or the southern temperate belts.

The disposition of the Southern Asiatics and the Central Americans is ilar, both of them mild and effeminate. In northern Mexico and the Gulf tes, the natives are less mild, but still teachable. Those natives of Asia next th of Siam and Hindostan, the Chinese and Japanese, show parallel traits. ien we come to the people of higher latitudes, the Tartar races, though proba- of the same Mongolian stock, their traits are different—more warlike, less ient, and less teachable. These facts must be considered when we forecast destiny of existing nations. In physical power and enterprise, the northern perate portion of the United States must always hold sway over the southern. is a natural law. Too far north the people become coarse; too far south, eminate.

We notice that Prof. J. C. Watson, of Ann Arbor, has no sooner returned from his trip to Pekin than he has discovered a new planet. It shines a star of the tenth magnitude. Its right ascension is 15 degrees and 16 es, and its declination 7 degrees and 3 minutes. It is moving west and

THE BRAIN.

BY PROF. CORNELIUS G. COMEGYS, M. D.

The following is the substance of an address delivered by Prof. C. G. COMEGYS, M. D., of Cincinnati, O., before the Society of the Alumni of the Medical Department of the University of Pennsylvania at their annual meeting in 1875.

Having seen extracts of this address, and finding them so scientific in character, and treating of subjects of such vital importance, the editor requested of the author a copy for publication, but owing to its great length we regret that we are unable to afford space for but a portion of it.

There is a department of legislation that may properly be termed State Medicine. It is the enactment of laws, for the control of the mode of living of the people, so as to prevent the development of sickness. It comprehends an amplitude and purity of water supply; an unadulterated food; an abundance of light and air; and the prevention of overcrowding and uncleanness in dwellings and public buildings, also, provision for drainage of lands and depositories of the excrement and offal of a community; the regulation of the hours of labor, and protection of early childhood from the imposition of toil; a suitable provision of rest days; the care of streets, the planting of trees, not only for shade, but, also, for the decomposing power of their leaves upon deleterious gases and miasmas; the establishment of quarantines to prevent the invasion of a pestilence; the isolation of persons attacked with infectious diseases, and the disinfection of localities where they prevail; the prevention of ill-assorted and consanguineous marriages; the registration of births and deaths; the burial of the dead; the construction and management of hospitals, and suitable provision for external aid to the sick poor; and, finally, the regulation of those two giant evils of civilization,—intemperance and prostitution.

All the measures for the accomplishment of these hygienic blessings come legitimately within the scope and capacity of medical practice, yet we are strangely neglected in their enactment and administration. I dare affirm that all the laws for the protection of society in regard to these subjects should be the result of our counsel, and participation in legislation. In my city, Cincinnati, there exists a reformatory institution called, truly enough, a House of Refuge, and thousands of youth have been its inmates within the last twenty-five years. In that time we have had several terrible visitations of cholera, scarlatina, diphtheria and small-pox, with not ten cases of sickness from all of them in that house, and not one death. What has saved them? Isolation and medical authority to direct the hygiene of the place. One may truly say, however paradoxically, that the best dwelling places for families, in our great cities, during an epidemic, are the reformatory institutions. Professor Dickinson, of London, has lately said in a public lecture that in that city more people die in a month, of diseases that might be prevented, than were put to death in France

eign of Terror; and for all England, during a year, more than were
the Franco-German war. Yet, this creates no public excitement
He modestly adds, "I think it will be well for the State when the
which we belong, is represented in the councils of the nations as
can be insured by official places, and conferred dignity"—that is,
suggest, in both houses of Parliament and in the Council of State.
to this again, but before I do so, I feel constrained to speak on
human action upon which depends so much of the happiness
the social and political state, but for the regulation of which
est any statutory provision. We are, however, under the gravest
m our professional knowledge, to point to its possibilities for
f great individual and public calamity. I allude to the per-
ind as dependent upon disorder of its material instrument—the

ature of the impact of the material and immaterial parts of us
ll explain; but there are laws of correlation which we do know;
of these, we are capable of exhibiting the results of their
he same way as those of other great organs of the body.

of a State, so multiplied and so vast, are often under the
a single individual; and history presents abundant testimony of
eoples otherwise prosperous and powerful, because of the indulgence
licentiousness, tyranny and an inappeasable thirst for conquest,
in the beginning exhibited self-denial, justice and peace. Auto-
in the general affairs of a people, exercising powers which are
for good or evil, as those possessed by him who sits upon a
rules an empire. We have seen in our time a fiscal autocrat, who
control the movements of our business world; and a railroad king
to bind the shores of our two oceans in his bonds of steel. In
instances, large communities often find themselves involved
idual who has gradually risen from humble beginnings to a position
importance that his good or bad fortune involves them in his
Such men possess, naturally, strong powers of mind, and slowly
stations by industry, abstemiousness, the faithful discharge of all
wisdom of their counsels and the display of constructive ability
administrative powers. Thus beginning, full of capacity for great
, they gain positions where they wield unusual power; and now
r begins and the public peril.

me in some detail while I follow these thoughts further, in order to
y assertion that the medical profession may justly claim the right to
y in regard to the abuses of the brain as well as of the other organs

n is the material basis of the mind, and is subject to all the physi-
l pathological laws of the other viscera. It has a great range of
an organ. It needs a simple supply of blood for mere nutritive

changes in its structure, but a much greater and momentary one when supporting mental actions. The vital chemistry must nowhere have so free a play as here. It must have rest, too; it becomes fatigued even by ordinary and unexciting uses; but, when inordinately employed for excessive periods, the balance of nutritive changes is disturbed—it wears excessively, and loses ability for the normal manifestation of mind. The mind is builded by the gradual formation of ideas, the materials of which are derived from the senses, but are shaped into concepts by an innate faculty. The accumulation and retention of these are the raw material of our intelligence. These factors, great or small, are stored away in associate forms, and constitute our isolated judgment of things, more or less simple, more or less compound and complex. They are also inseperably connected with our emotions and moral and religious sentiments, which constantly guide us in the discharge of our duties. A man in a controlling position should be able to employ all these resources calmly and sagaciously. His capacity for sound judgment and self-government rests upon his control of his intellectual possessions, and the due restraint of his affective nature which underlies them. He should have coolness for reflection and ableness to compare and combine them for the study of propositions of great enterprise; and the emotion which accompanies intellection must be so restrained that it incite not to baleful ambition. Now, this due exercise of mind for our self-direction depends upon the integrity of that dominant faculty which distinguishes man from all other animals—I mean the Will. Under this autonomy we possess powers for generalization, or abstraction of our conceptual stores; we can arrange and compare our notions, advance or restrain suggestions, eliminate or aggregate factors, suppress or stimulate emotion, and hold in check our baleful passions; but if this master-force be in abeyance we lose our autonomy, and become creatures of mere impulse—may not I say mere *automata*. All the fine powers for analysis or synthesis are shattered, and what remains of mind is a mere exhibition of "association of ideas," in forms more or less inco-ordinate. The treasures of knowledge are still held, but no longer coherent and under discipline; neither illusions nor delusions can be detected. Like a ship under full canvas, with no hand at the helm, filling, backing, moving ahead, but the voyage is a mere drift; or like a great army without an adequate commander to direct its march or its battles,—weak and dangerous in its vastness.

This supreme mental force is no transcendental entity to be considered apart from physical existence, but may be said, in its fullness, to be the correlative of the totality of the organic power of the brain. It is, therefore, only a well nourished and well rested and properly exercised brain that can display the freedom of this magnificent endowment of man. Let those fine physical qualities of the organ suffer deterioration by any excess, and self-control falters; drifting supervenes; the man begins to be led by mere associations of ideas; he lives in dreams. In the state we call dreaming the brain is not at rest, ideation goes on "in trains of thought;" we float in phantasmagoria; sounds, touch, odors, tastes, give them color; we are unable to verify our notions; illusions or

are realities; we have consciousness, pleasurable or painful, but it is
mercy of this automatic ideation. There is no Will in dreams. How
do we struggle for ability to strike down our tormentors or escape our
The Will is not free because the full power of the brain is not
There is too much blood in it for rest,— more than mere nutrition
for recuperation, and it works on with its processes of ideation; but
s no self-control.

ıave mentioned the affective faculties of the mind,—the basis of which
feelings of pleasure or pain,—that accompany and play upon purely
ctual acts, and regulate, in a large degree, their scope. But their
ıate exercise is particularly destructive of healthy brain function.

hus success exalts good feeling, which, if unrestrained, may go on to
y; while disappointment, if unresisted, tends towards melancholia; and
exciting or depressing passions, from undue indulgence, reduce the
; of the brain (by wear and tear, if you please,) in regard to the exercise
Will. This being in abeyance, the individual is exposed to the domi-
of the passions. To conquer, to grasp, to control, to hate, to lust, to
;e, to destroy; any, or all of the terrible elements of evil that dwell in the
ıay arise and govern the life of a man. An emotional or passionate man
ersally regarded as unfit to lead, and unreliable generally, because his
is subrogated to his passions, which seem to lie, like ferocious beasts, in
ıcade, ready to leap upon and destroy that reason. The state known as
blood" is recognized, and in law it often condones great crimes; but
as revenge, perpetrated in that state which is called "cold-blooded,"
with public execration, yet, pathologically speaking, they are on the same
; in both cases the inordinate exercise of feeling reduces the organic
tion upon which the dominion of reason rests; in the one case quick as
ghtning flash, in the other slowly undermining the physical domain.

n fever, in inebriation, and under moral shocks, we every day see reason
oned, and, alas, under powerful excitement, the vilest passions often
)unt and reign over the grandest minds.

Thus we see that the inordinate indulgence of our affective nature enervates
rain by wear and tear, and this loss of nervous force impairs the tone of the
lation of the blood in the penetralia of the organ; its pressure, rapidity,
ty, and volume are disturbed; the vital chemistry is impaired, the organic
gate is lower, and its functional, volitional incapacity begins This is the
e, physiological and pathological relation whereby the character of mind
ıs to be affected.

I have now reached the summit of my argument as comprehensively as my
moments will allow. I have attempted to show that upon the physiological
, a sound mind can only rest; that the inordinate exercise of the brain
ges and weakens its powers for reasonable action. That, reflection being
emotion becomes the guide of thought, and, depending upon the
or the individual, will be his own danger and the public peril. I have

not used the word insanity thus far, though I have said enough to exhibit this general definition—that, from its mildest to its gravest forms, it is a loss of voluntary power,—of the freedom of the will,—and it is from this stand-point that I reassert that the brain and its functions are under the care of our profession. We are able to declare that men, in the management of great trusts, spurred on by a vaulting ambition, or by excessive indulgence in mere animal passions and appetites, become dangerous to those trusts and all their environments. Be he monarch, commander, statesman, financier, railroad king, manufacturer, speculator, stock-gambler, or business man, the "delirium of greatness" fastens itself upon him, and renders him unsafe. Sooner or later he must fall. It is logic.

We warn men; but they will not heed us. They mock at our solicitude, and boast of their capacious, unlimited powers; but, sooner or later, the wear and tear shows itself; the ship steers wildly, because the pilot is losing his keen eye, and his firm grasp of the helm. We turn to the institutions of learning, and warn the teachers against the over-stimulating and over-working of the brain by multiplicity of tasks and mere memorative processes. The prize scholar shall become less useful to society than the laggards of a class who barely receive honors, yet who, later, gain posts of distinction, because they would not suffer over-working of their brains. We warn the people against luxuriousness, indolence, and the constant use of stimulants, and over-indulgence in any passion or appetite; for while many organs of mere animal function suffer, the great brain itself becomes undermined. Luxury is the parent of terrible vices. It is appalling to contemplate the social and national destruction which threaten us, on account of the inordinate indulgence of the passions of avarice, peculation, and lust,—progeny of luxury, and which have gone too far in the destruction of that public and private virtue which were the pride of our ancestry. Only industry, frugality, abstemiousness, self-denial, and purity of morals, can, under the blessing of God, bring us back to a position of security.

Rome did not fall because vast hordes of barbarians moved westward and southward under Alaric and Attila. It was the luxury which her accumulated riches developed, expressing itself in indolence and licentiousness, that extinguished her great families. Rome fell, says Professor Seely, because of the failure of the crop of Roman children.

On the other hand, we point out to parents and teachers the importance of the higher culture of the Will in the minds of the young. Nothing in the training of children seems to be so much neglected as this. It is well established that organs grow to conditions in which they are regularly exercised. This is so well known to be the case in regard to the muscular structure, that I barely refer to it to sustain the point that the brain also follows this law, and the capacity, therefore, for the higher forms of mental action for which the Will is so essential, may be cultivated by exercise, because the physical basis of the mind is thus enlarged. The notion that to develop a strong, healthy mental life by daily exercise in purposive thinking, is not a new one in medicine. The

ous Dr. Rush, while a professor in this school, in 1802, regularly visited
ceton College to give instruction in hygiene, and (as the venerable Judge
, of Cincinnati, says) he insisted that the student should exercise his mind
y day in close thought, in order to give expansion and stability to its
ties. Medical men often have occasion to advise severe study, in order to
mind of the patient from a mere sensori-motor life, into which it has
and that self-torturing known as "expectant attention," in which the
so infirm, may often be relieved by developing so much voluntary power
patient as consists in the restraint of a habit of continually making their
ts a subject of conversation.

is, indeed, discouraging to know that all that we say on these topics will
very little public interest. The influence of our profession is insufficient
its just respect. One great reason for this lack of public respect,
that more uncertainty exists in our science and art, than in other
We declare this to be unjust. We do not claim that medicine is
on the contrary, none feel its deficiencies more than medical men; yet
that a steady and brilliant growth exists, and that we are abreast of the
professions. We easily detect that there is as much uncertainty
of uniformity in their opinions and practices as in ours. It is an
task, but I must illustrate this point. Theologians are not uniform
of faith or church polity; far from being so in the interpretation of
writings. Lawyers, although their codes are written human expres-
not coincide upon their intent; after the most patient investigations
involving solutions of organic or statute law, they fail to agree.
from court to court, and at last the decisions are unsatisfactory.
n are no more at one on questions of States' rights, tariff, banking,
they were fifty years ago. The opinions of merchants and manu-
the course of trade are unreliable. These pursuits offer but little
fortune. The estimates of civil engineers and architects are
great uncertainty; and so I could enlarge and establish. I am
opinions are equally reliable, and should command as much
as those of other pursuits.

in the history of civilization was so large a number of learned men
and enthusiastically engaged in research for the advancement of the
moral interests of the people as is now furnished by our profession.
allowed to me to trace from the beginning of this century the march
progress and to show how much has been contributed to its well-
department by physicians.

first glance at the immense progress in the medical sciences in this
At its opening, anatomy was beginning to pass from its common des-
ts general forms. Now we know the minute anatomy of all the
our visual instruments have carried us further and revealed the
histology. Moreover, the quantity, arrangement and capacity of
the distribution of fluids, and for compound and complex movements,

have been demonstrated to be exactly in accord with the principles of pure and applied mathematics; and anatomy is as finished as is our knowledge of the solar system.

In physiology, the circulation of the blood was known, also the chemistry and physics of respiration; and the general facts of digestion, secretion, generation, and the phenomena of irritability of vital tissues, were fairly established. So, too, the sensory and motor qualities of nerves were known, but had not yet been specialized to any extent. General ideas, also, of the sympathetic nervous system existed in both its anatomy and function; but its expansion into all the recesses of the body associated with the muscular fibres of blood vessels and other organs for the purpose of regulating blood supply, and all functions of the body dependent on motion, were not understood. This grand acquisition is of recent discovery, and it is the key that unlocks the mysteries of pathology and therapeutics. Harvey's discovery without this of Bernard and Brown-Sequard, would have a limited value only, in medical practice, except in surgery. It is impossible to exaggerate the importance of this discovery. It has revealed so largely the material and dynamical conditions that constitute disease and the action of remedies. It enables us to generalize many empyrical facts of ancient and modern times; and the well-cultured physician of to-day finds himself in possession of data for the employment of methods similar to those of the calculus, in clinical practice; and he can show, in a multitude of instances, that what was in the beginning implicit in empyrical truth, has now reached the stage of explicit or demonstrative fact.

The brain was recognized, in general terms, as the centre of sensation and motion, and the seat of the intellect, passions and Will. But now the laws of organic life are more perfectly known; the centres of sensation and motion have been found; and the specialization of nerve territory, in relation to function, is so definite that we know the very seat, not only of the mere faculties of motion and its co-ordination for the execution of movements, instinctive and purposive, but we can put our finger on the exact region of the brain where the mental processes exist upon which depend our capacity to think—the area where sensations are shaped into concepts—where ideas are symbolized in language—where thought sits enthroned and the imagination displays its marvelous powers.* Moreover, the ultimate centres of vital action have been ascertained, and vitality, so long held apart from the common forces of nature, is now found to be correlated to them all. This last is the great and important doctrine upon which the science of hygiene rests, and it is a discovery to which physicians have most largely contributed.

In A. D. 1800, surgery was fully released from its baser associations and firmly united to medicine. What its triumphs have been, in its general and special departments, I need not here particularize. The knife, says Erickson,

* The faculty of memory, which of course involves thinking, has its seat in a portion of the left hemisphere supplied by the middle cerebral artery.

triumphantly carried into every organ of the body; and he thinks that
have quite reached their limits, and are so perfect in character that
new may henceforth be accomplished will come to be regarded as a
experiment on human endurance, and be held as a question of surgical
or an operative audacity. Capital operations are not only painless but
also.

word of tribute to the man who had the boldness to first employ an
subdues the consciousness of suffering while the surgeon performs
vork. This is the greatest event in modern surgery, and should have
d the intrepid originator to every earthly reward, and enrolled him among
atest benefactors of our race; but we have seen this poor man appealing
n to Congress for a recompense for the relief his discovery gave to a
ed army; and he died while going from city to city begging his bread.
d by, when no descendant remains to be proud of his name, statues and
nents will be erected to his honor; and a city, though rich in historic
, shall have nothing so glorious in its annals as that on the 16th day of
er, 1846, Dr. W. T. Morton, in its chief hospital, so reduced the sensi-
s of a man that a capital operation was safely performed while he was
scious of pain.

he ordinary practice of medicine, in the beginning of our century, was
barrassed by learned theories and systems displayed in the more recondite
ophic forms; but diagnosis was very limited and inexact, and diverse
es were greatly confounded. Therapeutics had become enriched by the
phs of cinchona in the cure of malarial fevers, and of ipecacuanha in
c inflammations; yet therapy rested too largely on blood-letting, evacuants
esolvents. Nature's supply of reserves for the emergencies of disease
not regarded as salutary, but rather as intrusive and destructive, and there-
o be combated; hence in inflammations and essential fevers the practice of
cians often added to the fatality of the disease. But now we know that
henomena in sickness are not only manifestations of disease of structure,
nction, but include also Nature's effort at restoration; and the great suc-
of modern practice consists in the management of conditions furnished by
e's efforts at restoration, rather than the direction of our energies to ex-
ish what are regarded as the morbid entities themselves. So many diseases
elf-limited that our office most often lies in careful conduction, rather than
roic efforts at extermination.

There is no time for me to enlarge upon the growth and perfection of our
ledge in morbid anatomy and in diagnosis. For the former, I will merely
ion the important discovery, that the most lowly tissue,—the connective—
w known to be subject to changes productive of destruction of functions,
only of such great organs as the lungs, liver and kidneys, but also of the
and spinal cord; but the progress of the latter seems to me amongst the
ondrous achievements of the age;—qualitatively it has a certainty that
he exact sciences. And, now, let me pay a passing tribute to a

man whose name, though familiar to us as a household word, yet is but little known to the world.

The discovery of the planet Neptune, twenty-five years ago, by the certainty of calculations, has given great glory to mathematical science; but this triumph of Leverrier was small and inconsequential to the world when compared with the successful achievements of Rene Laennec, in the discovery of the method of physical exploration, by which physicians can now determine with wonderful accuracy the diseases of the lungs and heart. The magnificent work of Laennec was the result of years of the most careful and extended study of living and dead bodies. The scattered hints found in antique and modern medicine furnished few suggestions to his success. His researches were more original and laborious, and far more disheartening, than those of Newton, Priestly or Lavoisier, for they had abundant data furnished by the successful study of mathematical, chemical and physical sciences. When we consider the many and complicated movements of the chest and its organs, and the varied and often contradictory phenomena in their diseases, and see how, step by step, he unraveled them all, and reduced them into intelligible categories, so few, so simple and yet so easily comprehended by the student, and withal so complete that those who have followed him have merely extended his observations without overturning any of his important doctrines, I believe that his genius, his patience and special toil are unparalleled, and entitle him to the reverence, gratitude and admiration of mankind.

It is not the mere knowledge of the human frame as a mechanism or diseased thing, as I have argued, that should give us highest consideration in the community; but our capacity to prevent sickness by securing the observance of the laws of health. At present we occupy positions but little better than those of mere advisers to authoritative bodies. Our soundest suggestions are at the mercy of ignorance and prejudice, in legislation.

It is well established by statistics that about one-half of the children of cities die under 5 years of age. They perish from epidemics and those diseases superinduced by the wretched modes of life they endure in the hot seasons of the year. Philadelphia has lost many thousands of lives unnecessarily, in the last five years, by such diseases as small-pox, scarlatina, diphtheria, typhus and typhoid fevers, and "summer complaints." If this had been the result of battle, siege, or anarchy, it would have sickened the entire civilized world; but it has produced little lamentation, outside of stricken families, except the groans in commercial circles from the interruption of trade from the country.

The medical profession holds itself ready, not only to diminish this fearful destruction of human life, but to destroy the contagia that cause it. I barely refer to the power to arrest the small-pox. We have tracked fever poisons to their lair, the squalor and wretchedness of the poor, and the foul emanations of excrement. It was the medical profession of England that stamped out the cattle disease as soon as they were adequately empowered. It was the destruc-

property that secured the power. We can also stamp out every infectious
but we must be clothed with plenary authority. When shall we have
in our hands? Only when we become a power in law-making, and can
a perfect hygiene for the poor. It is now well known that all of these
diseases may be disseminated in food. It is indubitably shown that
disease in the family of a dairyman, may be as widely diffused as
of milk. Certainly, if we possessed adequate powers, we could
out" the most destructive diseases.

the privilege of the practice of medicine is under no regulation.
who have studied the art under the most favorable conditions, find
confounded in the community with those who have the least notion
lives of the people are in the hands of greedy and ignorant men.
dangerous empiricism and shameless charlatanism impose themselves
upon credulity and good faith. No proof of knowledge or skill is
and the cities and the country at large are infested with quacks, who
poison and death with an audacity which our present laws cannot
The most impudent and depraved men assume the title of doctor to
gnorance and greediness. Never has the list of secret remedies
as now."

must work for adequate legislation in this matter. We do not ask a law
forbid a man practicing this or that, so-called, system of medicine,
hat all persons who propose to practice shall be obliged to make proper
hey have made the human organism and its diseases a systematic
In short, we ask no other test than that which the government has
hed for admission into the army or naval service. Is the life of a citizen
uable than that of a soldier? No man can assume the legal profession
t an adequate examination. Is life worth so much less than property?
are few of the multitude who need the aid of lawyers; but medical
, at some time or other, is required for all. Sickness and death are seen
y home.

ie points which I have discussed go to prove that if we would fulfill our
te duty to society, we must have a proper representation in legislative
The medical profession has a sufficient number of learned and well-
. men, from whom may be elected the most judicious law-makers. We
eek these positions; we must insist that State Medicine involves the
ing of the people as much, yes, more, than questions of property. The
, in England and on the Continent, is constantly growing, that physicians
participate in the government of the country. We have an example
one of the first medical men of the age serving actively in the German
nent—I mean Virchow. Trousseau was a member of the National
bly of France. Nelaton was a Senator of the Empire. Rush was a
of the Continental Congress, and signed the Declaration of Independ-
Graduates of this school have often been elevated to gubernatorial

places, many have served with distinction in both houses of Congress, and a multitude have been members of State Legislatures.*

But the participation in affairs thus far, by members of our profession, has not been so much on the theory of the necessity of a representation for purposes of State Medicine, as from the high character of the doctor and his broad intelligence and activity in extra-professional positions. What I wish to enforce is, that we shall claim the right to large representation in City Councils and State Legislatures, because we are more familiar, than any other class, with the needs of the multitude; and as due to our superior culture and fitness for these important places.

Far be it from me to advocate that physicians shall assume the role of the professional politician. Men who follow politics as a trade, should be regarded as public enemies. I hear at once the protest, that the true physician is a man of one work, and the usual admonition, "*Ne sutor ultra crepidam;*" but this is a narrow and miserable sentiment. If followed out by clergymen, lawyers, bankers, farmers, and merchants, it would relegate us to an age when government and all the interests of society were held by kings and priests.

Now, that I have spoken of our participation in politics for the purposes of State Medicine, I venture to propose the study of law for the practice of Forensic Medicine; a new specialty, if you please, but one which, if cultivated properly, will immensely advance our influence in society, and usefulness, too. I mean precisely this:—We have men of thorough education, and abundant professional experience and practice in extemporary speaking, who would make admirable practitioners in our courts of justice in that very numerous and widely diverse class of cases involving the mental and bodily ailments of the people. You know that we are now largely employed as counsellors in important cases, and that we are constantly summoned to court in the character of experts. Now, I believe that every physician in the position of a witness must have observed the embarrassment of many lawyers in trying medical cases; not that they do not ask questions enough, but their lack of medical experience renders them incapable of thoroughly developing what they have thus obtained. On the other hand, the well-trained practitioner, by his habit of careful notation of facts, becomes a master in the development and collocation of evidence and the arrangement of it for logical conclusions. It would not require a very large effort on the part of a well-educated physician to acquire the technical culture that would fit him for the bar. I believe that we all will agree that there are

*Edward Tiffin, who was born in Carlisle, England, landed here in 1784, and continued his medical studies in this school. He settled in Virginia, and rose rapidly to an influential practice; thence, in 1796, he removed to Ohio. He was elected to and served as Speaker of the first Territorial Legislature; was, in 1802, elected to and made President of the Constitutional Convention that organized the State—was twice elected Governor, and, during his last term, arrested the Burr-Blannerhasset expedition—was afterwards elected to the United States Senate, and, later, appointed by President Madison the first Commissioner-General of the Land Office at Washington; and he organized the system of surveys and sales that has continued to this day. And, yet, he was one of the first medical men of the frontier, particularly distinguished in surgery. The secret of his career of statesmanship has lately been discovered in an autograph letter of General Washington to General St. Clair, Governor of the Northwestern Territory, introducing Dr. Tiffin, whom he mentions, particularly, as very familiar with law.

professors in the different chairs in our schools who would shine as
in our courts of judicature.

In presenting these propositions before you, alumni, for a wider culture and
of action in our profession in the State, I declare that it is not to arouse
ition for place; but to aggrandize our position in influence and power
the advancement of social existence. The legal profession has been, since
of mere aristocratic government, the ruling class in society. We
envy them their self-assumed and lofty place. We are actuated by
jealousy nor rivalry. We claim only that we possess faculties for use-
in those high places that cannot, in the well-being of society, be
with. I address myself to young men of high aims and to thorough
and I ask you to consider these questions. I venture the judgment
participation in State and Forensic Medicine will not affect your
ness as physicians, but rather serve most potentially to strengthen our
ssion in its ability to promote good order in society and human happiness.

Again, there is a department of medicine which I believe should be
loped as a special one. I allude to the editorial work. Our periodical
ature has become so vast that it seems to me no one is adequate to its
lopment, in a journalistic way, who is withal a general practitioner. He
not the time. Such journals as are now needed to keep pace with medical
ements require as completely the time of leading editors as do our
lar press.

Two sorts of journals should be sustained: one mainly for local interests,
other for those that are national and inter-national. Now, a practitioner, in
r to see the leading journals of the world, is obliged to subscribe for a large
ber. Such a mass of literature cannot even be glanced at intelligently, and
ost and preservation are beyond the means of the average physician. We
l, therefore, a weekly journal so capacious as to be encyclopedic in char-
r, in which could be found, at least, a condensed view of the proceedings
listinguished medical societies in this country and in Europe; hospital
rts; notices and thorough criticism of new books; the republication of
ortant lectures and papers of eminent men, at home and abroad; a receptacle
of original home articles; the collection of the medical news of all of our
e cities; the careful record of new remedies and special practice, and the
ation of the progress of cognate sciences. Thus the busy, general practi-
er would find himself possessed, in one journal, of the fresh advanced
vements in every department of his profession, and might become familiar
n the names and work of the leading writers and teachers everywhere.
tly, such a journal would serve to fuse our vast profession into one mass of
lligence, feeling and force, and so enable us to wield more power for the
efit of society.

Finally, I come to the consideration of a reform in medical education, not
y for greater clinical usefulness, but as the necessary basis for a public
ognition of the lofty claims which I have set forth for our larger participation

in public affairs. When the University began, the literature of medicine was so limited that no proper instruction could be obtained from it. A student's library could be carried in his pockets. The prelections of the professor formed the great means of instruction. In the anatomical department, only, did there exist any adequate facility for private demonstration; and this is now the only department in which the student is required to do laboratory work. His time, then, was taken up in listening to lectures and writing out notes. Everything but anatomy was taken at second-hand; clinics were spectacles merely. The masters spoke of symptoms in a case, but the student had no opportunity of personal verification. The lectures were splendid, and the operations brilliantly performed, but only a small group could obtain any personal information on the subject. And hence it has always been a fact that first-rate students, who could endure the test of the severest examination for a degree, were less able to make a diagnosis in their early cases than well-trained nurses; and, in the presence of grave accidents that require quick, skilled work, were almost as helpless as by-standers. Their situation was just what would be that of a well-educated naval cadet who had witnessed at a distance, never so often, the manœuvres of a ship-of-war, but when placed on deck in command, would be more incapable of getting the ship under way, to prepare for action, than an old seaman who could not write his name. I need not add that the naval or military cadet is drilled and exercised like a common sailor or soldier, to gain practical experience, while he is being taught in the recitation-room the principles and technics of his profession so well that the "passed midshipman" or young lieutenant possesses very large ability to sail a ship in a gale, or to manœuvre a battalion in the field.

But, now, I must pause to say that the medical schools of our country, though deficient in ample plans for teaching demonstrative medicine, have given liberal and useful instruction to a larger number of men than all other institutions of learning in the nation combined. Thousands of young men have received, in Philadelphia alone, a training in natural history, physics, chemistry and psychology, as cognates to medical science, that has rendered them of great value to society, not merely as physicians, but men of culture. The study of man, as the Divine idea of mechanism in his terrestrial and cosmical, his physical and metaphysical relations, qualifies the student for capacious perceptions of duty, and inspires him with a desire to labor in every good work. While on this topic I feel bound to notice that the medical schools have been crippled in their usefulness for want of State concessions, and endowments by wealthy men. The resources of medical education have been derived from the profession itself. Millions of dollars have been given to other colleges, but no one has constructed a medical edifice, or so endowed a medical school that its teachers should not be dependent on students' fees. Nevertheless, under all the embarrassing circumstances, our Faculties have provided buildings, accumulated museums, libraries and apparatus, at vast expense, and have moreover assumed the gratuitous care of all the sick poor of hospitals and dispensaries. It is an unparalleled spectacle, and nowhere seen in the world but in the United States of America.

With these reflections on the neglect of the State and the want of public
and support for medical education, growing out of the inferior position
body politic, which we have tacitly consented to occupy; and with all
concession to the value and success of the methods of teaching of the past,
ıe now to ask for the future, and from this venerable University, a new

The age of teaching so largely by lecture has closed; the demands of
now are demonstrations. The student must be taught to acquire his
physiology, physics, chemistry, pathology, materia medica and practi-
with his own hand and eye. He can now, (thanks to the ample
on every theme,) learn in the office of his preceptor, and by his
study, all the preliminary knowledge that will fit him for experimental
observation in laboratories, hospital wards and amphitheatres.
condition of training he should come to the college, where his time
ıot be taken up so completely in formal lectures on topics which he has
earned, but rather in verification, by demonstrations, of the principles
he has seen asserted in his books. I would not displace the professor; I
only change his ground, and the relation to him of the student, who
do the work of demonstration himself, guided by his teachers. Formal
should not be abolished, but be regarded as of minor importance, and
far less of the student's time than heretofore. I barely remind you that
department has been organized on this principle of personal
by the student, though most inefficiently enforced. Under the new move-
each student should be required to perform, thoroughly and in stated
this laboratory work; so for physics and chemistry, morbid anatomy
rest. But, clinical medicine, more than all, for the classes should be
in small groups, in order to secure the closest personal scrutiny of the
na in diseased persons, and of the effects of modes of treatment.
to the inefficiency of our system, how many of the graduates of the
ıave been compelled to go abroad, at great expense and loss of time, to
the practical culture, which, under proper arrangements, could have
found on the most ample scale at home, in our great hospitals and dis-

our literary institutions and schools of technology a preliminary know-
is demanded for matriculation; and, after entrance, the pupils are required
l certain forms of recitation and demonstration. So it should come to be
ine. You must demand, professors, elementary knowledge for matricu-
to be shown by an examination; and then your courses of instruction
be so modified as to afford every facility to the pupil for a high quali-
for his duties as a physician. It will surely be necessary to extend the
of a session. In schools of engineering, in this country, each session
at least nine months, and is extended four years. In foreign medical
a session is double the length of ours, and about two years more are
to obtain a degree than with us. But if we can establish, as a rule, a

good examination as a requisite for admission, and a course of two sessions of demonstrative teaching of eight months each, and for two successive years,—it will place medical education on so much higher a plane than at present occupied, that the most advanced reformers will be content to wait patiently to see this well tried, before demanding a further advance.

I will forbear to offer much in detail for your consideration; but simply say that a progressive system of instruction is generally thought to be superior to the repetitive, now so generally employed. To bring every department of medicine at once before the student, has always been excessive; and the tramping from one lecture room to another for six or seven hours a day has exhausted the brain too much to allow opportunities for demonstration; and the final effort to be thoroughly ready for a successful examination in seven to ten subjects, in order to obtain a degree, has been nearly overwhelming. It has been accomplished by a dire effort of the memory, stuffed with the condensed information found in Essentials, Reviews, Conspectus, etc.; and the average student, when crowned with the doctorate, has felt that he was just about ready to go where he could get some practical information.

I have some experience, as a clinical teacher, to offer to sustain my views. I have, in concert with other members of the Cincinnati Hospital staff, attempted a course of ward instruction to classes not exceeding fifteen in number. It was so arranged that we gave them forty days in medicine, forty in surgery, twenty in opthalmology, twenty in gynæcology and obstetrics, and twenty in morbid anatomy; which covered the time of the didactic session of the colleges. Besides this, they received clinical lectures in the amphitheatre on these topics. I will only add, from many years experience as a teacher, that the ward teaching, as I make my daily rounds, is far more interesting to me than my amphitheatre lectures, which is teaching at a long range, as compared with the hand-to-hand work in the wards. It has been practically gratifying to observe, too, the effect on the student. Although this course is given as early as 8 o'clock, A. M., amidst all the vicissitudes of the winter season, it is rare to have a man absent at roll-call, so intensely do they become interested in this demonstrative work. How much more could we have done if the students' residence had been nine months instead of four and a half months?

It will not be difficult to employ this same method in every department of the course; and the result will be, if the course is lengthened, that the graduate in medicine will, not only by his real attainments, be in possession of greater personal self-respect and preparation to practice his profession, but medicine will thereby be exalted in the estimation of the public; who will be able to see without any self-assertion on our part, the difference between an educated physician and the thaumaturgic charlatan. It is particularly gratifying to observe that, by changing the location, this University has secured for practical clinical study the ample advantages of three great hospitals.

The nineteenth century has culminated, and slowly descends to the rest of the ages; but not with feeble frame, nor with tottering steps does it descend the

of time. In the lurid glare of battle and conquest it began. The revolt
monarchical tyranny on our shores had successfully established the
of a people to self-government. The declaration of Philadelphia had been
good. The light of our freedom had penetrated European skies and
a struggle for liberty. The destruction of a monarchy and the suc-
of a democracy were but momentary. Political freedom was soon drowned
Yet this brief moment of enfranchisement had sufficed to liberate
, and show its unlimited range. The triumph of intelligence was inaugu-
the love of research became general, and great men appeared, guiding
glowing intellectual movements of the new age. Thus was our cen-

grasp of the materials and forces of nature, and holding them subser-
to his purposes in the earth; the utilization of the most subtle and power-
about him; the enlargement of his vision of the most minute and
vast spaces; the penetration of the secrets of living beings by new pro-
of experimentation; the increased rapidity of his locomotion, and the
of his communication with distant places, for the diffusion of
that shall establish an interdependence of nations, exhibit man's
struggle to subdue the brute energies of matter, and force them into
of human happiness and greatness, and his irrepressible longing to gain
dominion over nature. And philosophy, pursuing its daring specu-
shall rest at last in the faith that the universe is one; that matter is
that nothing is superfluous and nothing is lost; that mind is
the category of nature, but nature is under the category of mind;
of all the creation, the human soul is alone endowed with faculties for the
and admiration of the Divine plans; that immortality is its
and essence: that "its capacity to know is illimitable, though not
and, with this motto, reason can never rest and never despair."

But this victory over matter and space has been surpassed in this century
enlargement of his benevolence in the care of the sick and infirm; the
of resources to prevent and cure disease; the construction of
for the blind, the dumb, and the insane; the elevation of labor from its
state of dependency and deprivation; the establishment of free schools and
for the instruction of the cammon people, and the penetration of the
world with the Glad Tidings. Thus the twentieth century shall find
race with an increase of intelligence, and possession of the stores of the
and powers of nature, and such amplitude of means to peacefully govern
world as was never before seen nor hoped for in human history.

THE Lake Superior mines, since 1856, have yielded nearly 7,000,000 tons
iron.

THE last orange crop of Louisiana amounted to 16,250,000, and realized a
profit of $810,000.

SOME ATMOSPHERIC PHENOMENA.

By the above title I propose to describe halos, ulloa circles and other phenomena caused by refraction or reflection of light, through watery particles.

The shadows of mountains or of objects upon them, are often seen thrown upon the surface of the mists and clouds on the side opposite to the sun. This phenomena occurs a few moments before sunset or after sunrise. The spectre of the Brocken is of this class. Sometimes these shadows are surrounded by colored concentric arcs, designated ulloa circles, the outer one being pale and whitish; this encircles several interior colored arcs. They occur at sunrise when there is a mist and the sun is not obscured; the shadow of the object appears in the center of these circles. The inside color of each circle (except the outer one, which is entirely white,) is red, the next color violet, the third yellow, the fourth straw color, and the last green. They move in the direction and follow the object which they surround. What is very remarkable is that

when several persons are upon a mountain, although each see the phenomena in his own shadow, none see that of his companions. Their size increases while their distinctness decreases, as the sun rises until they finally vanish. The number of the circles varies from one to five, being the most numerous and brilliant when the sun is brightest and the mists the thickest and near the earth. On July 23, 1821, Scrolsby saw a very fine one around the shadow of his head.

Kaemts observed while on the Alps that whenever his shadow was projected upon a cloud his head was encircled by a series of concentric rings of different colors. (See figure.) The circles are always concentric and their common center is a straight line drawn from the sun through the eye of the observer to the mists.

These phenomena are occasioned by the diffraction of light produced by the vesicles of the mists, the rays of light being deviated and decomposed by the

particles. When the sun is near the horizon and the shadow of the falls upon any surface wet with dew, as grass or grain, there is visible the light of which is brightest about the head of the shadow. In the aureola is occasioned by the reflection of light from the moist grass, brightest about the head because the grass near where the shadow of the is exposed to the light, while the other parts are comparatively

colored circles are seen whenever there is light and mists, and are on mountains whenever the traveler's shadow is projected upon A circle is seen about his head, more or less bright, and showing the colors. Other optical apperiances of an analogous origin are observed circumstances, as for instance if a person turns his back to the observes his shadow in water, the shadow will be much distorted and e starting from his head brilliant and luminous bodies which dart rays in all directions with great rapidity and for long distances. also a rotary motion around the head.

halo is another beautiful and interesting optical phenomena. It con- number of brightly-colored circles which surround the sun, sometimes by bands, arcs and bright circular spots of light. These concen- surround the sun at a distance of 22 degrees or 46 degrees. The light which sometimes accompany the halo resemble the sun and are or yellow in color. They appear on the circles at the right and left The same phenomena has been observed about the moon, but is so bright.

halo, when complete and accompanied by its various arches, bands and light, is one of the most brilliant and beautiful objects in nature, dis- it once bright and varied coloring and symmetry of form. A very per- observed by the author one afternoon in August, at Toledo, Ohio, is the illustration on the following page.

cause of this beautiful phenomena is the refraction of the sun's rays of ice in the shape of equilateral triangular prisms in the air; these being situated in all positions and every possible angle, give rise to the and decomposition of the rays—for the ray entering one of the three urfaces of the ice prism is changed in its course and traverses one of two in its way out. A halo must be produced at an angular dis- the sun equal to that of minnimum deviation twenty-two degrees. prisms chance to be vertical, the halo is replaced by two mock suns; axes of the prisms are horizontal, a halo of forty-six degrees, with the arcs and the parhelion circles, is produced, as in the illustration before

a halo appears in the sky, light cirri clouds are commonly seen, upon he halo is perceived, and the blue tint of the sky is replaced by a brilliant mist; a white vapor predominates in the vicinity of the sun.

Besides being necessary that the clouds in the higher atmosphere

Halo seen at Toledo, Ohio.

be formed of snowy particles, it is also necessary that they should not be
for then the light would be obscured; nor must they be too thin, for
case the halo would not occur. The crystallization of the watery
must proceed slowly, and not be disturbed by wind or currents of air,
a rapid or incommoded process of crystallization, the facets of the
ose their consistency, the surfaces their smoothness, and the angles their
Therefore, the halo, in all its various aspects, is explained by snow
falling slowly in a calm atmosphere, and is due to the refraction
rays upon crystals of ice, the different positions of the prisms being
of the diversity of the appearance of the halo.

colors of the circles of the halo are as follows: On the inner side—
to the sun—is seen red, which forms the concave border of the
follow orange yellow and green, in the order named—green forming
or convex edge of the ring. These colors diminish in brightness
he outer edge of the circles. These circles are from two to three
width, inclosing a central area, of which the sun occupies the center.
of the inner ring is twenty-two degrees; the outer ring is about
arge in diameter as the inner circle. This latter ring is produced by
of light across the dihedral angles of ninety degrees that the sides
make with their bases, just as the angle of sixty degrees produce
circles. Like the inner ring, the outer circle is composed of a suc-
colored rings, the innermost, or that on the concave side next the
; red, and the others following, as before described, in the inner circle.
the sun's light is reflected across the dihedral angles of sixty degrees,
six sides of the prisms of ice falling vertically form between them,
produced two parhelia or mock suns, one on the right, and one on the
sun, and on a direct line at the same height as the real sun. If the
the upper base of which the light is falling, turns rapidly upon its
road arc or circle is formed, parallel to the horizon and a great distance
sun; the arc thus formed is called the upper tangent arc of the halo
degrees, "or the circumzernthal" arc. This is always very bright,
the upper edge of the circumference of the outer circle of the
its concave side towards the zenith, and the convex side downwards
he sun. The colors being the same as in the two circles of the halo—
u being on the edge towards the sun, the violet being on the edge of the
or concave part of the arc. This circle is never seen when the sun is
lan twelve or more than thirty-one degrees above the horizon. Moreover,
alling and turning upon their axes will reflect the sun and form a luminous
band, parallel to the horizon, and passing across the center of the
dividing it into two equal parts, and extending across the center of the sun.
eflection does not separate the colors of light, this band appears white
he exact width of the diameter of the sun. Upon the surface of this
t the two points where it crosses the two encircling rings of the halo,
he mock suns, or parhelia, as they are called; hence it is called the
circle.

Finally, the prisms of ice that happen to be horizontal give rise, by tion and refraction, to tangent arcs, which appear one on each side of the halo ring. Besides halos, columns of light, crosses, and other curious are sometimes seen projected upon the sky at sunrise or sunset, occasioned the reflection of light upon the surface of ice crystals in the upper At Paris, just before sunset on April 22, 1847, a large luminous cross was seen with the sun in the center; its arms were each about fifteen degrees in length Columns of light are sometimes seen just after sunset or before sunrise, with the sun in their center; horizontal bands often cross these columns, crosses and other figures. The sun and moon are frequently surrounded colored rings of light, called coronas, formed by vapory particles of equal size in the atmosphere.

Such are some of the remarkable figures which have been the cause of superstitious fear and dread as portents of evil by the ignorant; but by the light of science their real character has been ascertained and found to be the natural results of the laws of light. By the progress of scientific research, and the patient investigation of students of nature, many of the seeming anamolous and frightful or supposed supernatural phenomena, foreboding terrible and disastrous events, are shown to be nothing but physical facts obeying the fixed laws of nature.

ÆROLITES.

These strange visitors to our earth always excite great interest wherever they appear. They have been met with in all parts of the world, no one place being more subject to them than another. They shine with an intensely bright light, and move with a great velocity — much faster than anything earthly, having the rapidity of celestial bodies. They explode with a great noise, shaking buildings like an earthquake, scattering stones, which fall to the earth with such force as to bury themselves many feet in the soil. When they first fall they are so hot that they have been known to turn the sand in which they bury themselves into glass, coating the hole so as to form a tube which could be taken out entire. They generally strike the earth in an oblique direction. In passing through the air they leave a bright train at night; in the daytime they appear surrounded by a gray smoke, leaving a cloud of smoke behind them. They have been seen to explode at the height of 30 to 40 miles. The following are a few notices of their appearance:

On a clear, bright day, about the hour of noon, while some men were at work in a field not long since, a loud detonation was heard, similar to the discharge of heavy artillery, but much louder. This was followed at an interval of two seconds by another report. These detonations were heard at a distance of 25 miles. Immediately upon hearing the sound, and before it had yet died away, there appeared to view at a great height an irregular shaped body, enveloped in a cloud of blueish-gray smoke. It moved very rapidly, leaving behind a long

of smoke. The noise it made when it struck the ground was audible
istance. On repairing to the spot where it fell several round holes were
so hot that the sand around their sides was turned to glass, forming a
tube. Upon digging down for a distance of two feet a dark grayish
stone was discovered, weighing four pounds, so hot that it could not
dled; but it soon cooled, showing that it was heated from the exterior.
ne which fell in France during the night, in 1868, broke into several
The sky was suddenly illuminated by a meteor that resembled a globe,
of fire, followed by a long train of flames. It was of a greenish hue, and
about six seconds, it exploded with a loud noise, scattering numerous
of stone which fell in all directions; they were of various sizes, the
weighing eight pounds. The detonation was heard 50 miles. After the
there remained for a short time a grayish cloud, which gradually
away.

neteor of great size and remarkable brilliancy was seen along the Atlan-
of the United States on the night of May 20, 1869. Its rate of motion
miles a second; it appeared to be about 50 miles high. It was as large
moon, and its effect was as that of a flash of lightning. It left behind
very brilliant train of light, which gradually faded away. It exploded
oud noise over the ocean, north and east of Boston. The explosion was
by a rumbling, like thunder. Its color was reddish, and it sent off
constant scintillations. Its diameter has been computed at 1,843 feet.
teor was seen at Philadelphia, New York, Poughkeepsie, New Haven,
and Boston, and intermediate points.

meteor appeared in Northwestern Ohio about 3 o'clock in the morning
27, 1869. The inhabitants of Findlay were awakened by a terrific
that shook the houses to the very foundation. On looking out a bril-
of fire was observed in the sky, rapidly approaching. It was about
of the moon; the whole heavens were lighted up. It was followed by
train of fire about thirty feet long and three feet wide. The night was
nd bright and very cold. The sound was heard 50 miles off, and the
very fierce and brilliant, and sent out bright tear-shaped drops which
out silvery bright and sparkling particles in great rapidity.

have been found to disturb magnetic instruments, showing that
e a great attraction for the north pole of magnets.

analysis of a block of meteoric iron by Prof. J. L. Smith gave the fol-
result. Its weight was 29 lbs.; density, 7.72:

omposition —

Iron,	90.61
Nickel,	7.84
Cobalt,	.78
Copper,	trace
Phosphorus,	.02—99.25

foregoing extracts give some idea of the phenomena of ærolites.

Unlike falling stars, which become extinguished in the upper regions noise and without leaving any trace of their existence, these bodies reac surface of the earth. They undoubtedly come from the region of the star do not belong to the earth.

Meteoric stones are of various shapes and sizes. They always have edges and depressions on their surfaces, and are coated with a black, crust, but of a grayish color within. One that fell in South America 30,000 pounds; another which fell in Arkansas weighs 1,635 pounds another weighs 14,000 pounds. Chemists have found 22 elements in them none not also belonging to the earth. Iron is the principal ingredient tuting 85 per cent. of their weight. Besides iron, the following have detected: Cobalt, alluminum, copper, magnesium, tin, chromium, sodium, manganese, sulphur, carbon, silica, hydrogen, oxygen, lead. These substances combine to form many mineral compounds, one which, called schreibersite, is peculiar to ærolites. It is a phosphuret o and nickel; is found in small particles or flakes, disseminated through the yellowish white in color; is magnetic and possesses polarity; its specific is 7.017. The specific gravity of meteoric stones themselves is about Their composition is different from anything found on the earth, althoug new elements are detected in them. Meteors present a remarkable similarity composition and appearance. Many theories have been given to accoun their origin. Laplace supposed that they were projected from volcanoes i moon and falling within the attraction of the earth were drawn to its but this does not account for their great velocity. Moreover, from the larg number falling on the earth, the moon itself would soon be reduced to a mer meteor and fall like the rest. Others have given them a terrestrial origin. Chladni supposes that they are small bodies circulating around the sun, which coming within the earth's attraction are drawn to it and become heated and ignited by the friction occasioned by their rapid motion through our atmosphere; the previously dark and invisible meteor becomes luminous and the ignited and incadescent particles becoming detached from the main mass form a glowing train of light behind the ærolite.

This is the theory now generally adopted and which more nearly accounts for all their phenomena.

THE Smithsonian Institute, in conjunction with the Indian Bureau, are creating a museum of antiquities illustrating the ethnology and archæology of the United States. This they intend to put on exhibition at the Centennial Exposition at Philadelphia. It consists partly of crania, weapons, utensils, ornaments and pottery. A movement is also being made to have the next annual meeting of the International Congress of Pre-Historic Archiologists at Philadelphia during the Centennial. This will enhance the interest and usefulness of the Centennial Exposition to a very great degree.

CARE OF THE EYE.

writing, reading, drawing, sewing, etc., always take care that the
:omfortably cool, and the feet warm; there is nothing tight about the
'here is plenty of light without dazzling the eyes; the sun does not shine
on the object we are at work upon; the light does not come from in
\ is best when it comes over the left shoulder; the head is not very
:nt over the work; the page is nearly perpendicular to the line of sight,
he eye is nearly opposite the middle of the page, for an object held
is not seen so clearly; that the page, or other object, is not less than
from the eye.

.s apt to increase rapidly when a person wears in reading,
.ntended to enable him to see distant objects.

:ase, when the eyes have any defect, avoid fine needle-work, draw-
maps, and all such work, except for very short tasks, not exceeding
:ach, and in the morning.

study or write before breakfast or by candle light.

.ie down when reading.

:yes are aching from the fire light, from looking at the snow, from
or other causes, a pair of colored glasses may be advised, to be used
Light blue or grayish blue is the best shade, but these glasses are
be abused, and usually, are not to be worn except under medical
Almost all those persons who continue to wear colored glasses, having
irst received advice to wear them from medical men, would be better
them. Traveling vendors of spectacles are not to be trusted; their
apt to be recommended as ignorantly and indiscriminately as in the
the ' Vicar of Wakefield."

'have to hold the pages of *Harper's Magazine* nearer than fifteen
order to read it easily, it is probable that you are quite near-sighted.
:o hold it two or three feet away before you see easily, you are
far-sighted. In either case, it is very desirable to consult a physician
a pair of glasses, for a *misfit* may permanently injure your eyes.

play tricks with your eyes, as squinting or rolling them.

eyes are often troublesome when the stomach is out of order.

:eading or sewing by twilight, or when debilitated by recent illness,
fever.

seamstress ought to have a cutting-out table, to place her work on
plane with reference to the line of vision as to make it possible to exer-
:lose scrutiny without bending the head or the figure much forward.

ually, except for aged persons or chronic invalids, the winter temper-
work-rooms ought not to exceed 60 or 65 degrees. To sit with impu-
a room at a lower temperature, some added clothing will be necessary.

of a student or seamstress should be kept comfortably warm while tasks
lone. Slippers are bad. In winter the temperature of the lower part
room is apt to be 10 or 15 degrees lower than that of the upper.

It is indispensible in all forms of labor requiring the exercise of visio minute objects, that the worker should rise from his task now and then, tak few deep inspirations with closed mouth, stretch the frame into the mos posture, throw the arms backward and forward, and, if possible, step to a or into the open air, if only for a moment. Two desks or tables in a room ar valuable for a student; one to stand at, the other to sit at.

CONSUMPTION OF FORESTS.

It is said that nearly one-half of the surplus hard woods of the are to be found in Western Virginia. How long these will last is a question. Taking the one item of railroad ties, and we find that the requires for its annual supply 94,530,000 cubic feet, equal to 738,515 cord solid timber, to secure which at least 2,000,000 cords of standing timber hav be cut down. The average product per acre of the forests of Virginia is give by M. F. Maury at from 40 to 50 cords per acre; so that, taking the maximu yield, our railroad ties alone destroy annually 40,000 acres of woodland. Th annual consumption of the country for fuel is estimated at over 50,000,000 cord of wood, of which three-fifths may be assumed to be good standing timber cut expressly for fuel. This gives an annual clearing of 600,000 acres. The iron foundries consumed in 1870 635,000 tons of charcoal, and a furnace that makes six or seven tons of iron a day will use up 200 acres of woodland in a year The annual product of charcoal iron is now about 200,000 tons, using up 5,000 acres a year. The pine lands of Michigan, the best in the country, yield 10,000 feet to the acre, board measure.

The annual consumption of the country in manufactured lumber is 2,000,000,000 feet, representing an annual clearing of 2,000,000 acres. The fencing of the country requires 25,000,000 acres to be cleared in order to make it, and the annual repairs to fencing destroy 25,000,000 acres of forest. Our shipping tonnage represents 80,000 acres of oak forest destroyed, and demands for repairs 4,000 acres a year. The hard and turned wood manufactures of the country use up an annual average of 300,000 acres of timber.

Taking all these items together, we have an aggregate annual consumption of 5,500,000 acres of forest. As our total forest-lands amount to 380,000,000, they will last at this rate only 70 years. A certain percentage of forest destroyed is allowed to renew itself, and, as in 70 years a pine woods can be cut over twice, this renewal amounts to a very considerable figure, but it is scarcely sufficient to offset the increasing demand for timber for every purpose to keep pace with increasing population and exigent industries in the same period. In other words, with our present system of husbandry and our present growth of population, 70 years makes the maximum period that our forests may be expected to hold out.—*New York World.*

*THE ARCHIPPUS BUTTERFLY.**

(*Danais Archippus.*)

BY W. SAUNDERS, LONDON, ONTARIO.

This large and beautiful butterfly is one of the most common of our sum- r insects. It makes its first appearance on the wing about the middle of but is not very common until the latter part of the season. It passes the in a state of torpidity, hidden in some sheltered spot, where it sleeps ıntil awakened by the warmth of spring. The few individuals which ɛarly appear, lay their eggs on the tender leaves of the young milkweed ; (Asclepias cornuti,) and other species of asclepias, and also on the bitter (Apocynum androsœmefolium). This takes place during the latter part of ɔr the beginning of June.

Colors—Bright orange, red, black and white.

The eggs when first laid are white, but in two or three days they become w, and then dull grey just before the time of hatching. They are 1-25th ı inch long, conical in form, flattened at the base. When viewed with a ıifying glass they appear very beautiful. They are usually attached by base to the under side of a leaf. On each egg there are about twenty-five d longitudinal lines or ribs, and about the same number of pross-lines, ·een each, so that the whole appears covered with a regular and beautiful net- :. In about six or seven days the egg matures, producing a very small rpillar, one-tenth of an inch long, with a large black head and yellowish- e body, with a few black hairs on each segment or wing. This caterpillar ʃs very rapidly, and soon finds that its skin, although very elastic, will bear no ıer stretching, when it conveniently disrobes itself, and appears in colors ı and gay, by simply crawling out of its skin through a rent down the back

* Annual report of Ontario Commissioner of Agriculture.

which takes place just at the proper time. This process, which is called moulting, is repeated three times during the growth of the larva, and requires no other preparation for its accomplishment than a short fast. Any abstemiousness shown at these critical periods in the creature's history is, however, soon compensated for by the enormous appetite with which it is furnished as soon as the crisis is past.

The full-grown larva is about one and three-quarters inches long. The head is yellowish, with a triangular black stripe in front below, and another of a similar shape above. The upper surface of the body is beautifully ornamented with transverse stripes of black, yellow and white; the white covering the greater part of each segment, and having a wide black stripe down the centre, while yellow occupies the spaces between. On the third segment (reckoning the head as first,) are two long, black, fleshy horns, and on the twelfth two others of a similar character, but shorter and not quite so stout. The under side is black, with a greenish flesh color between most of the segments.

The next change which comes over this caterpillar is that which transforms it to a pupa or chrysalis, a most astonishing transformation, when the voracious larva becomes for a time torpid, senseless, and almost motionless, while preparing for that change when it is to appear in brilliant plumage and gracefully float and flutter through the air, enjoying the summer's sunshine and sipping the nectar of flowers. Kirby, in his "Introduction to Entomology" says, "were a naturalist to announce to the world the discovery of an animal which for the first five years of its life existed in the form of a serpent, which then penetrating into the earth and weaving a shroud of pure silk of the finest texture, contracted itself within this covering into a body without external mouth or limbs, and resembling more than anything else an Egyptian mummy; and which, lastly, after remaining in this state without food and without motion for three years longer, should at the end of that period burst its silken cerements, struggle through its earthly covering, and start into day a winged bird — what think you would be the sensation excited by this strange piece of intelligence? After the first doubts of its truth were dispelled, what astonishment would succeed! Amongst the learned what surmises! what investigations! Amongst the vulgar what eager curiosity and amazement! All would be interested in the history of such an unheard-of phenomenon." Yet the changes which the insect we are referring to undergoes in common with many others, is scarcely less wonderful or startling.

The larva hangs suspended from a silken web in which its hind legs are entangled, and which has been previously attached by the caterpillar to the underside of a leaf, or fence rail, or some other secure place of retreat; and here, while hanging for about a day, the larva contracts its length and increases its bulk, especially on the anterior segments. By and by a rent takes place in the skin down the back, and the chrysalis begins to appear, and after long and persevering efforts in stretching, contracting, and wriggling the body, the skin is crowded backwards and worked nearly up to the hinder extremity; and now

presents itself, and a feat has to be performed to imitate which puzzle the most daring acrobat, for without hands or feet to hold on by, to draw itself from the remnants of its larva skin, and hang itself up by a protuberance crowned with a bunch of hooks at the extremity of the

Although this feat is so wonderfully difficult, it is very seldom indeed a failure occurs in its accomplishment. The joints of the abdomen being movable, are first stretched against a portion of the larva skin, and by a en jerk backwards the skin is grasped and firmly held while the terminal ents are withdrawn, and the process of suspension completed. Soon after the chrysalis begins a series of wriggling and jerking movements with the of dislodging the empty larva skin, after the removal of which it remains onless unless disturbed, and becomes gradually harder and more con- ed.

The chrysalis is about an inch long, and of a beautiful pale green color ted with gold, and with a band of golden dots extending more than half round the body above the middle; this band is shaded with black. There so a patch of black around the base of the black protuberance by which it spended, and several dots of the same on other portions of the surface. chrysalis state seldom lasts more than ten or twelve days, and towards the ration of this period the handsome green and gold colors begin to fade, and chrysalis grows gradually darker until the diminutive wings of the future terfly show plainly through the semi-transparent enclosure. The escape of imprisoned insect, now nearly ready for flight, is usually made quite early in morning. We have several times watched for their deliverance, and have ally found it to take place soon after daybreak. A sudden crackling and ht tearing sound is heard, which arises from a splitting of the chrysalis case t way down the back; the fore legs, head and antennæ are first withdrawn, l in a very short time the entire insect is liberated. Strange looking creaes they are when they first present themselves to view, with bodies so large o be out of all proportion to the tiny wings. When fully developed their gs measure about four inches across, but when fresh from the chrysalis they about the size of those of a large bee. The first necessity now for the welfare of the individual is to find a suitable location where the wings may be held a good position for expanding, for without such favorable circumstances they uld never attain a serviceable size. It is necessary that a position should be ured where the wings can hang down as they are expanding, for which reason underside of a twig is often selected; and here, securely suspended by the arp claws with which the feet are furnished, the wings undergo in a short time most marvellous growth it is possible to imagine. We have seen the wings uble their size by actual measurement within three minutes, and the whole from the time of the escape of the butterfly to that of the full development of the wings, seldom occupies more than from fifteen to twenty minutes. re the sun is high in the heavens, on the morning of its birth, the soft wings have dried and become rigid, and the butterfly is ready for flight.

A wing clipped from the insect immediately after its escape, and examined under the microscope, reveals the fact that the thousands and tens of thousands of scales with which the wings are covered, and which afterwards assume such beautiful feather-like forms, are now nearly all linear or thread-like, not folded up or wrinkled, but undeveloped. Impressed with this thought, one is fairly astonished at the almost incredible change wrought in so limited a time, for the growth embraces not only the extension of the membraneous surface of the wing, but the enlargement and maturity of every scale or feather on it, the individuals of which appear but as particles of dust to the naked eye. What a wonderful and intricate system of circulation and power of nutrition must be possessed to accomplish this marvellous result.

The Archippus butterfly (See cut) is so well known that it needs but little description to recall its appearance, especially where so good a figure is given. The ground color of the wings when fresh is a beautiful bright orange red, the veins are heavy and black, and the margins are spotted with white, the latter being more or less covered or encroached upon by the general color. Near the middle of the hind wings there appears in the figure, on one of the veins, an enlarged black streak or blotch, which, when closely examined, is found to be a small excrescence: as this is found only on the wings of the male, the sexes may be readily distinguished by this peculiarity.

We have frequently seen these butterflies in great numbers on pine trees which have been infested with aphis, attracted there no doubt by the sweet exudations which flow from the bodies of the aphis, thus interfering with the rights and privileges which have always been accorded to the industrious ant. They also have a fashion of congregating at times, usually late in the season, in prodigious swarms, consisting of tens of thousands or hundreds of thousands of individuals. In September, 1871, we met with a swarm of this character, the particulars of which were communicated to the *Canadian Entomologist*, vol. 3, p. 156, as follows: "On the first day of September, while driving along the Lake Shore Road on the borders of Lake Erie, I was favored with a sight which will not soon be forgotten. For several days previous *archippus* butterflies had been unusually abundant, and early in the morning on the day in question, some groups — numbering probably hundreds of individuals — which had rested during the night on trees adjoining the hotel at Port Stanley, were gyrating in a wild manner at all heights, some so high up that they appeared but as moving specks in the sky; others floating lower, over the tops of the trees in an apparently aimless manner. This was, however, as a mere skirmishing party when compared with the vast hosts seen a little later.

"It was about nine o'clock in the morning, when, passing a group of trees forming a rude semi-circle on the edge of a wood facing the lake, the leaves attracted attention; they seemed possessed of unusual motion and displayed all over fitful patches of brilliant red. On alighting, a nearer approach revealed the presence of vast numbers — I might safely say millions — of these butter-

s, and they were clustering everywhere. I counted those on a small space, ut the size of my two hands, on one of the trees, and there were thirty-two tterflies suspended on it, and the whole group of trees was hung in a similar ner. When disturbed they flew up in immense numbers, filling the air, and loating about a short time gradually settled again. There appeared to be g on the trees to attract them, yet when undisturbed they seemed to resting in quiet, as if enjoying the presence of congenial society. I ted not having a net with me, as I should like to have captured a number m, to have seen in what proportion the sexes were represented in the com- Their food plants — the various species of *Asclepias* — did not appear to usually common in that section. I apprehended that many of the indi- ls must have traveled some distance to be present at this gathering." No ictory reason has yet been assigned for such gatherings. The fact that rva of the *archippus* is but seldom affected with parasites may partially nt for their occasional abundance; we only know of one small ichneumon ing them, and have but rarely met with this.

TY ONE HUNDRED AND EIGHTY THOUSAND YEARS OLD.

The remains of a very ancient city have been discovered near the present of Cherokee, California. From the position of the relics, geologists esti- that they must be not less than 180,000 years old, judging from the nt rate of change going on upon the surface of the earth. The traces in tion are numerous stone utensils, such as mortars, found in undisturbed e and yellow gravel, of a subaqueous formation, not fluriatile, underlying sheets of volcanic rock, of which Table Mountain is a part. In one nce a mortar was found standing upright with its pestle in it, apparently as it was left by its former owners. In some instances the mortars have found at a depth of forty feet from the surface of the gravel underlying le Mountain.

The distribution of the relics is such as to clearly indicate the former ence of a human settlement on that ancient beach when the water stood the level at which they occur — a time long anterior to the volcanic out- ring which Table Mountain records, and also long anterior to the glacial ch.

The recent geological history of that region may be briefly summed up as ows: Previous to the placing of the mortars in the position in which they e been found, the early and middle teriatry sea-level had receded to the ition of the coal-beds underlying Table Mountain, fully one thousand feet the level of Cherokee. Subsequently, in the pliocene period, there was subsidence of about fifteen hundred feet, something like six hundred after the mortars had been abandoned. All this, as has been

noticed, took place before the volcanic outflows which covered up all the ancient detritus of the region including that of the ancient rivers (whose gravels have furnished so much of the gold of California.) The geological age of the river period was determined by Lesquereux for specimens of vegetation, now extinct, collected in the survey of the ancient rivers; specimens indicating a flora of pliocene age, retaining some characteristic miocene forms.

After the volcanic period the land rose again, the time of emergence embracing the glacial period and the new eroding period in the sierra, during which the slates and the hard metamorphic greenstones and the granites were slashed with canons three thousand feet deep by the action of ice and running water. Taking the rates of continental movement determined by Lyell, our geologist calculates that the time required for the changes thus outlined could not have been less than eighteen hundred centuries. For a period so long preceding the glacial epoch as the time when ancient Cherokee was buried by the waters of the advancing sea, his estimate is certainly not extravagant, though it does transcend so enormously the time men have been accustomed to allow for man's residence upon earth.

THE SNOW PLAINS OF CENTRAL ASIA.

The days pass—some in wild fierce storms of snow and sleet, that howl around us as though all the demons of the steppe were up in arms, some in bright sunshine, whose intolerable glare blinds us and blisters our faces. From time to time we drive down into darksome underground holes, hot and reeking hover around the steaming samovar, pouring down oceans of boiling tea; then out on the silent steppe again, to continue the weary struggle. There are nights when we awaken from a half-frozen sleep, and remember we are in the heart of the mysterious regions of Asia, and see nothing but the wide, snowy steppe, silent and ghostly in the spectral moonlight. For miles and miles there is no human habitation, but the burrow-like stations somewhere far ahead, buried under the snow. There is something strangely oppressive and awful in the changeless monotony of these wide, snowy plains, level as a floor, where for days and weeks you see nothing but snow and sky. There is the breadth and loneliness of the ocean without its movement, the cold and icy silence of the arctic regions, without the glory of the arctic nights—the silent desolation of an unpeopled world. Those broad, level plains, over which the icy winds from Northern Siberia come rushing down in furious blasts with an uninterrupted sweep of a thousand miles, and drive the snow about in whirlwinds that go scudding over the plain like giant spectres; the short days of sunshine, when the glare on the snow dazzles and burns: the long cold nights, passed in a half-frozen, half-somnolent state, with the tired beasts trudging wearily forward;—I shiver now at the bare remembrance of it all.—*Campaigning on the Oxus, and the Fall of Khiva. By J. A. MacGahan.*

OCEAN CABLES.

The following table, taken from the *Journal of Telegraph*, gives a list of cables over 500 miles long. Besides these there are 71 cables less than long and 40 between 100 and 500 miles long:

From.	Length in miles
—Ireland to New Foundland,	1,896
—Malta to Alexandria, Egypt,	925
to Duxbury, Mass., via St. Pierre,	3,330
Bushire, Persia, to Jask, Beloochistan,	505
St. Pierre to Duxbury,	749
to Aden, Arabia,	1,469
Aden to Bombay, India,	1,818
Porthcurno, England, to Lisbon,	823
Gibraltar to Malta,	1,120
Madras to Penang,	1,408
Singapore to Batavia,	557
Malta to Alexandria, Egypt,	904
Ratabano, Cuba, to Santiago, Cuba,	520
Java to Australia,	1,082
to Cochin China,	620
Saigon to Hong Kong,	975
Hong Kong to Shanghai,	1,100
Shanghai to Japan and thence to Siberia,	1,200
Antigua to Demarara, West Indies,	1,268
Porto Rico to Jamaica,	582
Falmouth, England, to Lisbon,	1,150
Valentia to Newfoundland,	1,900
France to Denmark,	550
Pernambuco to Para, Brazil,	1,382
Alexandria, Egypt, to Brindisi, Italy,	930
Lisbon to Madeira,	633
Valentia to Newfoundland,	1,900
Madeira to St. Vincent,	1,360
St. Vincent to Brazil,	1,953
Jamaica to Colon, S. A.,	660
Brazil to Rio Janeiro,	1,240
Jamaica to Porto Rico,	582
Rio Janeiro to Rio Grande de Sul,	840
l to Rye Beach,	3,000

the brain a chance as well as the arm. Do not let the animal eat up Let the body be the well-fashioned hulk, and the mind the white hoisted, bearing on towards the harbor of glorious achievement.

NEW REVELATIONS IN A SNOWFLAKE.

It is difficult to believe that the pure white snowflake, which settles lessly upon the earth and which seems, even when moderately magnified, but mass of exquisite white ice crystals, is, after all, but a scavenger of the phere. But such, nevertheless, is the fact, and henceforth we must regard snowdrops as but so many sponges, which absorb into their porous the myriads of microscopic bodies which form that peculiar atmospheric found near the surface of the earth, and most largely in the vicinity of This dust is itself a queer mixture of heterogeneous substances. In a drop water obtained from a single snowflake and magnified 500 times, were pieces of coal, fragments of cloth, grains of starch, sandy matter, and an mense variety of other substances, not a fragment of which exceeded in diameter three ten thousandths of an inch. The iron and other particles in the snow probably are not without some effect on vegetation. Certainly, however, it appears that heavy snow falls, besides clearing the atmosphere, washing it of a impurities as it were, protecting the ground against excessive cold, serve fertilize the same through the nitrate of ammonia conveyed to the soil by the melting of the snow —*Scientific American.*

THE MOMENTUM OF HEAT.

Heat is one of the modes of motion. The sun is the source. Vegetation springs up, matures, and decays as the continued round of change goes Old forms are buried beneath the new, which rise upon their ruins. Thus immense beds of fuel been hidden for centuries beneath the earth's surface Born of motion from the sun, acting upon the matter, these deposits stored-up inertia, to be changed into momentum. All matter is ponderable has weight, whether it is gaseous, or fluid, or solid, and of course possesses momentum, when under motion. In speaking of the motion of particles their weights are to be considered: those which have the highest motion have the least weight. The carbonaceous deposits called coal are simply combined elementary particles of different natures and when set free give out their force to whatever they may come in contact with. Phosphorus and sulphur have their particles easily disturbed; for this reason they are put upon matches. The motion of the hand easily sets their momentum free; the wood of the match is next acted upon, then light kindling matter, then the coal. On and on this process goes, increasing in force as fresh fuel is added. It is momentum from first to last, originally stored in the coal, and set free to be used for the benefit of man. To apply it in a manner that will utilize it best, is his province. When water receives this transferred momentum or heat force, among its own particles, it becomes steam. Steam is simply water in molecular motion. When the water has received its molecular motion, or when the steam is formed by its momentum, and applied to the piston of the engine, the wheels are turned, the train is set in motion, and continues until the momentum is restrained by outside resistance, or the supply of fuel is stopped. Thus did momentum begin and end its work, merely set free by human power, man acting only as the agent.—*J. M. Hicks.*

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DECEMBER, 1875. NO. 3.

THE WATER OUZEL, OR AMERICAN DIPPER.

(*Cinclus Mexicanus.*)

ittle bird that, as Dr. Cooper says, possesses the habits of a of a sand piper, and the song of a canary, is one of the most of all the feathered inhabitants of our country.

an established fact that many of the birds of Mexico and other countries, entirely unknown to the States east of the Mississippi river, quite frequently in the interior of the Union, and quite far north, along the range of the Rocky Mountains, and the great central plains, species of Southern birds wander quite into British America. The ow under consideration is a fit example. Originally considered an Southern bird, it has been traced in the interior as far north as and Lake Athabasca. The American Dipper is found only in districts, near streams. The genus to which it belongs has long stumbling-block to ornithologists. The species were first classed by as Sturnus, then SCOPOLI placed them under Motacilla, LATHAM referred

them to the genus Turdus, and BRISSON placed them under the sand-pipers, (Tringa,) and finally the poor little bird was put by TEMMICK among the ducks, so that it was pushed from one place to another, as it might please the fancy of the writer.

The Dippers or Water-Ouzels are readily distinguished by their short, even tails, their compressed, subulate bills, which are slightly bent upwards, notched, and the cutting edges bent inward and finely notched towards the tip. The legs are long and strong. The plumage thick, compact, and oily, rendering it impervious to water. When immersed it runs and drops off immediately. The neck is short, the body stout and also short. The wings short and rounded, the third and fourth quills longest, the first always very short. Nostrils basal, oval, and half covered with a membrane. Tongue bifid at the tip. The lateral toes are equal, the outer united to the middle by a web at the base. The sexes are always alike in colors. They all moult twice a year.

Our little friend is wild and solitary in its habits, frequenting clear mountain streams whose beds are covered with pebbles, or strewn with rocks and stones. It is only met singly or in pairs. They are very shy, timid, and cautious, seldom alight on trees, but keep near the streams, on stones and rocks. They perch in an attitude peculiar to themselves, with their short tails pointing upward and jerking from side to side, while the bird is intently watching for its prey, which consists of water insects. As soon as one is discovered they plunge into the water, and walk about for a long time under the surface, being capable of remaining for a considerable time beneath its surface, where it can be observed running about on the pebbles on the bottom of the stream, searching for fry, constacia, mosquitoes, and other insects and their larvæ, which constitute their food. The water seems to be their element. The web-footed birds swim and dive, the long-legged birds wade until the water reaches their bodies, but the Ouzels alone possess the faculty of walking at ease beneath the surface of the water on the bottom, as other birds do on the dry land. They are careless about the depth, and run easily against the current. They may be seen dodging about under the water, with the greatest ease and apparent delight. They run very rapidly, and their flight, although not long sustained, is very swift and direct. They frequently plunge directly into the water, without previously alighting. They are also fond of flying in and out of waterfalls, and skimming over the surface of the water. Their voice is shrill and weak. They sing sweetly but not very loud, while perched on their favorite rocks, cheering the wild and lonely places they frequent with their clear and sweet melody. They pair early, have two broods in a season, and the young run before being fully fledged. The nest is large, and is placed among the rocks overhanging the water, or very near it. It is always carefully hid, but can be found by the incessant chirping of the young. In some cases they have been known to build nests in bridges, mills, or other human structures. They sing more or less the entire year. While on the wing they utter a feeble cry. In plunging into the water, as soon as it is deep enough to cover them, their head is stretched out

and the wings at the same time opened, dropped and agitated con-
and they descend to the bottom, where they run about after food.
appear covered with bubbles of air, rapidly emanating from their bodies.
devour their food beneath the surface of the water. They also fly beneath
with great ease. The young, when frightened, dive into the water for
The eggs are four or five in number. The nest is spherical; its floor is
of twigs and small sticks, the sides and roof arched over like an
and projecting over the entrance to protect it, of moss. A nest described
BREWERS and RIDGEWAY'S Birds of America was a complete hemis-
composed outwardly of living, green moss. Within was a strong, com-
apartment, arched over and supported by twigs, with a cup-like
at the bottom, hemispherical, and composed of roots and twigs firmly
The structure was seven inches in height, externally, and had
of ten and one-half inches at the base. Within, the cavity had a
six inches. The entrance, which is on one side, is three and one-half
n breadth, and two and one-half in height. The eggs were three, of a
dull white. They measure 1.04 inches by 0.70 inches, elongated, oval,
at one end.

of the Bird—Bill, without bristles at the base, slender, subulate,
upwards; the culmen, or top ridge of the bill slightly concave
to near the tip, which is arched and turned down to the point; com-
or cutting edges notched and inclined inwards; the frontal feathers
the inner angle of the nostrils. Feet large, extending beyond the end
tail. Tail very short, not two-thirds the broad and concave wings.
spurious; third and fourth longest; second, between fourth and fifth.
as long as middle toe; lateral claws just reach base claw on middle toe.
on middle toe has its inner side extended into a broad lamina, which
of notches or teeth on its edge The tail is nearly even, and so
hat the upper coverts nearly conceal its entire length, extending almost
ip. The tasi are covered with one entire scale, which meets behind in a
edge. *Colors*—Above, dark plumbeous; beneath, a paler shade of the
color. Head and neck, all around, light, sooty brown; a concealed white
the anterior angle of the eye; legs, pinkish white; bill, brown. Im-
specimens shaded with grayish white below, the greater wing coverts and
tipped with the same colors. *Dimensions*—Length, seven and one-
extent of wings, eleven and one-half inches; wing, four inches;
and one-half inches; bill, one-half inch; tarsus, 1.20 inches; middle
inch.

The Water-Ouzel is unsocial, recluse, and cautious, even hating the society
own kind, and will not tolerate the society of its mates, living alone and
most secluded places. So fond of the water are they, that they have
seen to fly and run under the surface of streams covered with a sheet of
has been known to dive into the stream, then fly to its nest and mount-
ts top, will shake itself, sprinkling the water over the nest to keep the

moss wet and fresh. In motions and attitude it resembles to a great degree the wrens, when perched constantly moving the tail up and down in quick jerks. Its favorite place to perch seems to be stones and rocks in the middle of streams, where it watches for its prey.

THE MOUND BUILDERS OF THE MISSISSIPPI VALLEY.

BY ISAAC SMUCKER.

The mound-builders have been, still are, and probably are destined ever to remain to us an unknown people—a people whose national history has never been written, and in all likelihood will forever remain unwritten. Their origin is enveloped in impenetrable obscurity,—their history is surrounded by such a degree of uncertainty and mystery as to remain, through the ages, an unsolved problem. They were a race whose acts and deeds never became the subject-matter of permanent record. The brush, the pencil, the pen, the chisel, the graver, the written language probably never existed among them. To perpetuate for any long period the memory of the heroic deeds and civic virtues of a race without a written language or a literature, and with but *meager* if *any* knowledge of architecture, painting, and sculpture, is an utter impracticability; hence, we have nothing but mere glimmerings of knowledge approaching reliability or authenticity, of the mound-builder race. This much, however, it may be premised, is known with certainty of the mound-builders, that they were unmistakably one of probably many of the prehistoric races that have existed in America during the last three thousand years.

By prehistoric races or peoples are meant those which inhabited the American Continent before Christopher Columbus, the Genoese navigator, discovered the West India Islands while making his several voyages under the patronage of Spain, during the last decade of the fifteenth century, and the immediately subsequent discoveries of the Cabots, on the main land in 1497, now nearly four hundred years ago. True, there is good reason for the belief now generally entertained by well-informed men that Zeno's expedition from Venice in the fourteenth century reached our coast, as did also that of Madoc, the Welsh adventurer, in 1170, A. D., and that the Northmen sailed to North-Eastern America, by way of Iceland and Greenland, coasted along Newfoundland and the New England shores and effected a landing there, and possibly established, temporarily it may be, a settlement as early as during the closing years of the tenth century; but it is also true that the daring adventure of those early navigators amounted, practically, to very little in the way of accumulations to the general stock of historical or geographical knowledge. Certainly they failed to bring the mound-builders within the historic period; but that may have been for the reason that that ancient, mysterious, and little known people were not at that time, *if ever*, occupants of the country bordering on the North-Eastern Atlantic coast.

Very little, indeed, that is reliable, or that approaches authenticity, is known
:he peoples or races that inhabited America before the discoveries of Colum-
'n 1492. The ruins and earth works of extinct races and unknown peoples,
ich the western solitudes disclosed to our earliest Caucasian explorers, and
ions in which the mythical element largely predominates, and which are
of little value, are the only means vouchsafed to us of getting at the
pertaining to those peoples and races.

As the mound-builders unmistakably antedate the era of Columbus, they
of course be classed, with certainty, with the prehistoric peoples or races of
Clearly they belonged to prehistoric times, if I am correct in the
presented, that the Northmen failed to obtain any knowledge of them, or,
ained, neglected to transmit it to the generations that came after them.
if the Northmen of the tenth and eleventh centuries actually made the
of the mound-builders, which is not probable, the knowledge thus
became practically valueless by the neglect of the former to make a
:ecord thereof.

Traditions respecting the mound-builders are of comparatively little worth,
we are compelled to depend mainly upon their stone and earth-works, the
memorials left by them, to help us to work out the solutions relating to their
their history, their habits, their manners, their customs, their general
:heir mode of life, their knowledge of the arts and of husbandry,
state of civilization, their religion and its rites, their ultimate fate, and the
and circumstances of their final absorption, dispersion, or extinction.

As I have indicated, there is no reason to believe that the mound-builders
had a written language, and if they had not, it must be evident that very
purporting to pertain to their history, could, by possibility, be fully estab-
by *incontrovertible* evidence. It is to be feared that we will never have a
knowledge of them than we have now, and we have little at present more
authentic, or reliable than vague speculation, fables liable to lead into
guesses uncertain and untrustworthy, legendary tales, fictitious narratives,
probably fabulous, incidents, if any, wholly unsubstantiated, and tradi-
perhaps that may or may not be attempted to be supported by testimony.

The story of the social and national life of the mound-builders doubtless
consisted of the collected, compiled, arranged and embodied facts, inci-
s and information grouped together in such shape as to constitute, in a form
be perpetuated, in a reliable authentic manner, to succeeding generations.
n these opinions I am not in error, we are of necessity in a measure unen-
as to their history, of the deeds of prowess of their heroic men, of their
virtues, and achievements. Generation after generation of them
flourished and passed off the stage of action, but no record of their ex-
has come down over the intervening centuries to us. But their still
works of earth and stone furnish us *some indications* of their peculiarities
characteristics, and afford us *some data* as to the probable history they made
the unknown and, perchance, barren, uneventful cycles of their

indefinitely long career as a nation or race. As theirs is an *unwritten* history as yet, and likely to remain so, it is a matter of gratulation, surely, that everywhere throughout the Mississippi and Ohio valleys are found way-marks and traces of this ancient and mysterious race. Their foot-prints are found in great profusion on every hand, and their works abound in great variety and numbers, as well as of great magnitude and immense proportions. Let us then take a look at and examine with some care these works of the mound-builders, so that we may establish such facts pertaining to them as we may, and approximately arrive at as many others as we can, raise as strong presumptions in favor of many more, and offer as sound arguments as we are able in favor of other positions taken, conjectures offered, and views presented. We may thus possibly establish some facts as to the mound-builders—raise a strong presumption in favor of other supposed facts in relation to them, and render at least plausible and probable the truth of other positions maintained. Let us then turn our attention to the works of the mound-builders, and see what facts are fairly deducible from them—what they teach—what instructions they afford us—what we can learn from them about their constructers. What, then, are these works of the mound-builders?

To the mound-builders we can properly ascribe only such monuments or remains of ancient works as were really regarded by the North American Indians themselves at the time the first white settlements were made in the Mississippi valley, as antiquities, or the ruins and relicts of an extinct race, and "concerning the origin of which they were wholly ignorant, or only possessed a traditionary knowledge." Of the kinds of ancient works here indicated there are three general classes, namely, *Mounds*, *Effigies*, and *Enclosures*.

Mounds are generally composed of earth, though a few built of stone are found, and sometimes both earth and stone were used in constructing them. They are classified and known by the various titles of *Sepulchral* mounds, *Sacrificial* mounds, *Temple* or truncated mounds; mounds of *Observation*, and *Memorial* or *Monumental* mounds.

Sepulchral mounds are generally conical in form, built of earth, though some are of stone, and are more numerous than any other class. They are of all sizes, ranging from a very few feet in height to seventy feet, and always contain one or more skeletons, or give other plausible indications of having been built or used for purposes of sepulture—that they were indeed memorials raised over the dead. The American *Cyclopedia* is responsible for the notion that the size of these mounds bears a certain relation to the importance when living, of the personages over whom they were erected; and instances that at Grave Creek, ten miles below Wheeling, in West Virginia, on the banks of the Ohio river, which is seventy feet high, and quite symmetrical in form; also, that near Miamisburg, on the banks of the Big Miami river, twelve miles below Dayton, which has a height of sixty-eight feet, as mounds in which were buried those of "high consequence among the builders of these monuments." In this class of mounds are often found implements and ornaments, supposed to have been

with the person or persons there interred, under the superstitious and
belief still entertained by some tribes of American Indians, who still
to this practice, that they might be useful to the deceased in the future
of existence or Spirit world—a practice which may have come down to
from the mound-builders. That fire was used in the burial ceremonies is
by the quantities of charcoal found just above the remains. The
of ashes sometimes, and other traces of the action of fire in these
makes it quite probable that fire was employed in some way, in the
rites of the mound-builders. Mica is often found in near contiguity to
'n these mounds In sepulchral mounds are also frequently found
of pottery, generally of unskilled workmanship, likewise bone and
beads, and animal bones. I participated, in an indirect way, some years
in the partial opening of one of this class of mounds, which was done care-
so far as it was done at all, and which was so varied and extensive in its
that I feel constrained to give the facts concerning it somewhat in
as I did on the occasion of the late convention of Archæologists, at
The mound in question was of medium size, and symmetrical. It
of conical form, with a base of forty feet in diameter, and a vertical height
twenty feet, and is situated on the farm of Thomas Taylor, about
miles south of Newark, Ohio. The exploration was made by Professor
(paleontologist) of the Sheffield scientific school connected with Yale
and occupied his attention a number of days. George P. Russell, of
Massachusetts, Charles W. Chandler, of Zanesville, Ohio, and a number
of Newark, interested in the local antiquities of that section of
state, assisted him. Professor Marsh prepared a paper, in which he gave
facts connected with the exploration of this mound. The paper, after
read before the Connecticut Academy of Arts and Sciences, was published
July number of the American Journal of Science and Arts, for 1866, and
appeared in pamphlet form. Among the contents of this medium-sized
mound, which was only partially explored, were ashes, charcoal, flint, a
pipe of soft limestone, pieces of a tube of the same material, a string of
one hundred native copper beads, strung on a twisted cord of coarse veg-
fibre; also shell beads, human skeletons, decayed layers of reddish brown
layers of burned clay, white chaff, implements of various kinds, lances
arrow-heads, six hand axes made of hematite and green stone, a hatchet, a
chisel, a flint scraper, many bone implements, five needles or bodkins, from
to six inches in length, made of the bones of the deer, an implement for
pottery, numerous peculiar implements, made of the antlers of the
and elk, a whistle made of the tooth of a young black bear, some spoons
of shells, a vessel of coarse pottery, fragments of a vase, a variety of
bones, belonging to the elk, deer, rabbit, wolf, woodchuck, and river
and also various other things, including seventeen human skeletons, in
or in part. No bones of domestic animals were found.

Sacrificial mounds are frequently found within enclosures, which were sup-

posed to have been, in some way, connected with the performance of the religious rites and ceremonies of the mound-builders. Their altars of stone or burnt clay, rest upon the surface of the original earth, in the center of the mound, are symmetrically shaped, and are one of the distinguishing characteristics of the class. They generally contain ashes, calcined bones, implements of war, articles of pottery and sculpture, and often ornaments for the person. The stratification feature of this class of mounds is one of their peculiarities, the strata being composed of a layer of clay and loam, alternating above a layer of fine sand, that covers the altar itself. Some sacrificial mounds seem also to have been used for purposes of sepulture as well as for sacrifice, the presence of skeletons in some of them proving their sepulchral character also. The mound-builders' skeletons, in many instances, are found, says the American *Cyclopedia*, in close proximity with relics of art, which display much greater skill than was known to exist among the tribes found in occupation of the country at the time of the discovery. Among those were "elaborate carvings on stone, pottery, often of elegant design, articles of use and ornament in metal, silver and native copper from Lake Superior. Also mica from the Alleghenies, shells from the Gulf of Mexico, obsidian, and probably also porphyry from Mexico, are frequently found side by side with the remains of the mound-builders in these ancient tombs."

Temple or truncated *mounds* are less numerous and generally larger than the preceding classes, and in shape are sometimes circular, often oval, and are always truncated, having the appearance of half-finished mounds. They are frequently surrounded by embankments, and have spiral pathways, steps or inclined planes leading to their summits. From their form, and the very general absence of relics in them they are believed to have been used as *Temples* or "high places," on which were performed some sort of religious ceremonies. They are generally of large base and comparativtly limited height, and level on the top, though some are of great height as notably that at Cahokia, in Illinois, which covers nearly eight acres of ground, a parallelogram in form, and ninety feet high! The supposition is that the summits of *Temple* mounds were crowned with structures of wood that served the purposes of Temples, all traces of which, however, owing to the perishable materials used in building them, have disappeared.

Mounds of Observation are generally situated upon eminences and were doubtless used for the purposes indicated by their title. A writer, (R. S. FULTON, ESQ., of Cincinnati,) who has given much attention to antiquarian matters, says, that this class of mounds "occurs in chains and regular systems, and that many of them still bear traces of the beacon fires that were once lighted upon them." *Observatories*, answering the purposes of *Mounds of Observation*, are frequently found in connection with defensive works, and are in some instances only portions (very greatly enlarged and elevated) of the embankments of what are supposed to have been defensive works. Some recent writers have called these mounds "alarm posts," "watch-towers," "signal stations," "out looks."

archæological friend, SAMUEL PARK, ESQ., of Marshall, Illinois, who has
American Antiquities with much zeal and industry, has found that
of Observation are very numerous in some localities, and that many
o the other classes, are really *Mounds of Observation.* He also observes
these signal mounds are not always found on the highest hills, but where
ommand the most complete view of the whole land, whether below or above
ocation, and where they can be seen from the greatest number of other
by views through valleys, or between distant hill tops." This feature
design as well as a good degree of skill and economy in securing the
of their erection with the least possible amount of labor. In proof, he
one on a *hill side* that commanded the view of an adjacent valley, which
of the hill did not.

GE FORCE, of Cincinnati, in an interesting essay on the mound-builders,
he following pertinent points in relation to this class of mounds: "Along
river are dotted small mounds on projecting high-lands, which seem
been built to carry intelligence by signals along the valleys. And by
at Norwood, signals could be passed from the valley of Millcreek
Little Miami valley, near Newtown, and I believe to the valley of the
Miami, near Hamilton. A chain of mounds can be partially traced from
Cincinnati mound to the fort at the mouth of the Great Miami; and
COX, who is better acquainted than any one else with the mound-builders'
in Hamilton county, says *the chain is complete.* SQUEIR and DAVIS report
of signal mounds along the Scioto, through Pickaway and Ross counties,
county; and MR. SULLIVANT, of Columbus, told me that he once
a series of signal mounds along the Scioto, from Dublin, on the northern
of Franklin county, to beyond the southern line of said county into
county; and added he had no doubt, though he had not verified it by
observations, that the chain was so continuous that a signal could be
flashed from the lines of Delaware county to Portsmouth, on the
River."

Memorial or *Monumental* Mounds belong to the class of works that are
to have been erected to perpetuate the memory of some important
or in honor of some distinguished character. They are mostly built of
but some of the stone mounds found in various sections of our country
are of this not numerous class. The Jewish Scriptures advise us of
nt practice among the Hebrews, of erecting "great heaps of stones"
of perpetuating the memory of some important event, whether good
Jacob and Laban, (to mention a few cases in point,) raised such a mon-
on Mount Gilead in memory of their covenant. Joshua also erected one
of stones of the Jordan, to preserve the memorial of his miraculous
over that river. And the Israelites that dwelt beyond Jordan, also raised
upon the banks of the river, as a testimonial that they constituted but one
with their brethren on the other side.

It has frequently been a matter of surprise to persons who explored mounds

that no human bones were found in them. The reason may be clear if they were mounds of this class. They correspond with our Bunker Hill, our Saratoga, and New Orleans monuments, and with those erected in honor o Washington, Jackson and Lincoln.

Sepulchral Mounds were erected for burial purposes; *Sacraficial Mound* for the purpose of offering upon their altars the sacrifices demanded by thei religion; *Temple Mounds* for the purpose of practicing upon their summits thei religious rites and ceremonies, unconnected with sacrifices; *Mounds of Observation* were the "high places" built by the mound-builders, from whose elevated tops observations could be made in times, perhaps, of threatened danger, and perchance serve the purpose of "signal stations;" and *Memorial or Monumental Mounds* for purposes already indicated.

SYMBOLICAL MOUNDS.

I proceed to consider the second class of the works of the mound-builders known as *Symbolical Mounds* or *Effigies*, sometimes also called *Animal Mounds*. They are simply raised figures or gigantic *basso relievos* of men, beasts, birds and reptiles, on the surface of the earth, raised to the height of a few feet, (generally from one to six feet,) above the natural face of the ground. In some instances inanimate objects are thus represented. MR. SCHOOLCRAFT, an authority, calls this class of ancient earthworks, *Emblematic Mounds*, and expresses the belief that they were "*Totems*," or heraldic symbols. The American Cyclopedia characterizes them as a most remarkable variety of earthworks, and which are commonest in Wisconsin and Iowa, but of which a few examples are found in Ohio. The same authority further remarks that they challenge our wonder by their number, variety and extent. And JUDGE FORCE, of Cincinnati, remarks in one of his very able and learned addresses read before a Literary and Scientific Association, and published not long since, that Wisconsin is dotted with this style of mounds, as if the ancient race had used it when it was a prairie, as a vast parchment whereon, by the picture writing of these effigies, they inscribed their "history."

As an example or two of *Symbolical mounds*, I name the following: And first I mention one situated near the center of an ancient circular earthwork, a mile and a half south of Newark, Ohio. It is called *Eagle mound*, from its supposed resemblance to the eagle. At all events it represents a bird of immense proportions, with its wings outspread. Its elevation above the surrounding surface is not great, nevertheless sufficient to present, with a good degree of distinctness, a huge bird on the wing. Its length must be about two hundred feet, and nearly as much from tip to tip of wings. The exploration of this bird mound brought to light an altar, which gave indications of the presence of fire upon the stones and earth composing it, while the charcoal and ashes upon it, strongly suggested sacrificial offerings.

Another, the *Alligator Mound*, as it is called, is situated upon the summit of a hill nearly two hundred feet high, and is six miles west of Newark, Ohio,

within a mile of the village of Granville. The shape and form of this rep-
nonster are distinctly presented, so that all that see it, even at the first
admit that it was undoubtedly intended to represent the Alligator, or
Crocodile. His entire length is two hundred and five feet. The
breadth of the body is twenty feet, and its length between the fore legs
ind legs is fifty feet. The legs are each twenty-five feet long. The head,
shoulders, and rump, have an elevation varying from three to six feet,
the remainder of the body averages a foot or two less. The head, tail,
egs, gradually taper off to their termination. It is composed of earth and
stone, also, and has become somewhat unsymmetrical and uneven on the
ce, caused by the clearing of the land about it, and also by the blowing
of the trees that had grown upon and near it. Moreover the freezings
hawings, and the rains and snows of the passing centuries could not have
in some measure at least, to mar its symmetry, its regularity of form, and
partially obliterate it in places. In despite of the action of the destruc-
he heavy, devastating hand of man, and the wasting, all-devouring
of Time, it nevertheless still remains a good effigy of the great American
He lies with his head nearly to the west. On the north of him,
feet or more distant from his body, is a slight elevation or small pile of
called an "Altar," upon which fire is supposed to have been used. This
has a diameter of a few feet only, and from it a narrow, barely percep-
elevated, graded way, leads to the effigy, reaching it midway of the
It is believed that this "Altar" and "graded way," were much more
features at the first settlement of the country than they are at present,
Altar" having been reduced in size by the removal of some of the stones
composed it. The learned author of "Prehistoric Man" expresses the
that this work "symbolizes some object of special awe or veneration,
on one of the chief 'high places' of the nation, with its accompany-
Altar,' upon which these ancient people of the valley could witness the
of the rites of their worship, its site having been obviously selected
most prominent natural feature in a populous district, abounding with
civic, and religious structures." The writer hereof last year visited the
Mound," accompanied by Professor Wilson of the University of
author of the aforementioned work, with a view of verifying his meas-
in contemplation of the early publication of the third edition of
Man," as well as for his personal gratification. Upon a full view
effigy and of its surroundings in detail and as a whole, he gave no
of a wish to change the opinion he had expressed in his learned
that this mound served a purpose in the religious worship of the mound-

erhaps one of the most elaborate and remarkable of *Symbolical mounds*, is
near Brush Creek, in Adams county, Ohio. SQUIER and DAVIS and the
can *Cyclopedia* have brought it to the notice of the public, as have others
ed in antiquarian research. It is in the form of a serpent, more than a

thousand feet in length, extended in graceful curves, and terminating in a coil of the tail. The embankment which constitutes the effigy is upwards of five feet in height, by thirty feet base at the center of the body, somewhat toward the head and tail. The neck of the figure, says the *pedia*, "is stretched out and slightly curved, and is opened wide, as if in act of swallowing or ejecting an oval figure, which rests partly within the tended jaws. This oval is formed by an embankment four feet high, and perfectly regular in outline, its transverse and conjugate diameters being hundred and fifty and eighty feet, respectively. The combined figure has regarded as a symbolical illustration of the oriental cosmological idea of serpent and the egg; but, however that may be, but little doubt can exist of symbolical character; and that it and others of its class were connected the religious theories, rites and ceremonies of their builders." Perhaps were the objects of their idolatrous worship even. The Egyptians and Asiatic and other idolatrous nations, and superstitious peoples and races as sacred certain animals, and even worshiped them! The idolatrous builders may possibly have been worshipers of the inanimate representation those animals, as well as of the mere representations of inanimate objects.

I remark, in concluding what I have to say on *Symbolical mounds*, that same kind of figures, traceable to the mound-builders, are sometimes seldom, found, as *intaglios* instead of *basso relievos*—as depressions protuberances—as excavations instead of elevations—as figures formed digging and throwing out the earth, instead of forming them by the tion of earth on the surface. They are more appropriately introduced in nection with effigy mounds, than with any other class, but I am unable to any considerable information as to locality, extent, or purpose.

Having only barely mentioned the fact of the existence of *Stone Mounds*, I may be permitted, before passing on to notice *enclosures*, to have a word or two about some prominent ones that have come under my observation. And it may be remarked also, that stone mounds were doubtless erected for the same purposes that the earth mounds were. And the first I name is situated about eight miles south of Newark, Ohio. Its diameter is one hundred and eighty-three feet, and its present height does not average over ten or twelve feet. The height of this mound at the first settlement of the country, was probably thirty-five feet, and perfectly symmetrical. This and all other stone mounds that have passed under my eye, are conical in form. This mound is situated on an elevation, and was built of good sized stones, of tolerably uniform weight, more than half of which probably have been removed and used in building cellar walls, and largely in the walls and locks on the Reservoir and Canal near it. A wooden sarcophagus, (if it is proper to use the word as applied to anything but stone,) containing a few remnants of a human skeleton was found in this mound some years ago.

Another stone mound is found about six miles north-west of the foregoing, and about eight miles south-east from Newark. It was, when first found, forty

diameter and nearly twenty feet high. An attempt made many years ago
it, by throwing the stones down over its sides from the top, resulted in
its height to about ten feet, and increasing its diameter at the base to
feet. The late JUDGE SCHOFIELD, of Lancaster, who was Government
during the early years of the present century, ran the section lines
one of which crossed this mound, made an entry upon his field notes,
designating its locality, pronouncing it "*a singular pile of stone.*"

ne other only I name. It is situated on a high hill, within an enclosure
of stones, about five miles north of Somerset, Ohio. It has a diameter of
thirty feet, and was probably eighteen or twenty feet high, but its diame-
been somewhat increased, and its height diminished, as in the case of
ceeding, and for the same purpose. It still remains an height of twelve
more.

om the location of these stone mounds, all being on high ground, (the
d last named on the highest in the vicinity,) and from the other facts
, the reader can judge as well as the writer, of the purposes of their
n.

come now to describe briefly the third and last general class of mound-
rs' works, commonly called *Enclosures.* They are further subdivided
alled *Military or Defensive*, and *Sacred Enclosures*, most of them being
ucted of earth, a few of stone. *Defensive Enclosures* are of *irregular*
always found on high ground and in strong positions, frequently on the
its of hills and steep bluffs, and are often protected or strengthened by
or ditches. "The walls," says a late writer, "generally wind around the
rs of the elevations they occupy, and when the nature of the ground ren-
some points more accessible than others, the height of the wall and the
of the ditch are proportionately increased." The gateways are narrow,
number, and well guarded by embankments of earth placed in the inside,
overing them, and in some cases are further protected by projecting walls
her side of the entrances. There is a succession of this description of
, (Defensive Enclosures,) from the Northern Lakes to the Gulf of Mexico,
all indicate a clear appreciation of the *elements*, at least of fortification,
unmistakably point out the purpose for which they were constructed.
e not erected, says the American *Cyclopedia*, in close proximity to streams,
n cases where springs are not embraced within their lines, artificial reser-
are always found for holding water, and other indisputable provisions for
tanding siege as well as sudden attack, are observable. A large number of
defensive works consist of a line of ditch and embankments, or several
within auother, carried across the neck of peninsulas or bluff head-
rmed within the bends of streams—an easy and obvious mode of forti-
common to all rude peoples.

his class of enclosures belongs one of stone walls, situated on the top
gh hill, five miles north of Somerset, Ohio. It embraces probably twenty
and was a wheat field when I saw it in 1864, bearing its first yield of grain;

having been "cleared" the year before. Within it stands the stone moun
which I have made mention. The natural position is one of great strength
quite defensible. The stones that composed its wall, now lie in the utmos
order. Its shape is a triangle, having two long sides.

Another is situated near the village of Bourneville, Ross county,
twelve miles west of Chillicothe. It occupies the top of a very high hill
is remarkable for its abruptness, being at some points inaccessible. A
wall of several feet in height, measuring two miles and a quarter in length
enclosing an area of one hundred and forty acres, extends around the
little ways below its brow. Two others, one a parallelogram of more tha
hundred acres, and another a square of sixteen acres, are found in th
county.

Still another defensive work is found on the summit of the range of hill
which is situated the "Alligator Mound," already described, and about on
east of it, and five miles west of Newark. Its walls are of earth, and
probably a hundred acres of land. The well-known and often describe
at Circleville, Ohio, belong to this class.

But the most notable of this class of works is at a place near the
Miami river, called "Fort Ancient," in Warren County, Ohio. The enclosur
situated on a plain, nearly horizontal, about two hundred and thirty-six feet
ATWATER, above the level of the river, between two branches, with very
and deep banks. The embankments are nearly four miles in length, varyin
height, according to the natural strength of the point to be protected, fro
to twenty feet, and embracing several hundred acres. It is called Fort Hill
is one of the most extensive of its class

This description of works were clearly of a military character.
strength of their position, their location upon eminences, their irregularit
form, and other facts, circumstances and surroundings, indicate with a
degree of certainty, that they were constructed for defense, and that their pr
jectors in the selection of positions to be fortified, and in the
strengthening of the naturally weaker or more accessible points liable to attac
exhibited no inconsiderable degree of engineering and military skill.
walls of earth, of limited height, it may also be remarked, are frequently i
contiguity to *Enclosures*, sometimes indeed connecting them, by running fro
one to another. They are called *covered ways*, and it is thought that the pr
tection of those passing to and fro, was the purpose of their erection.

Sacred Enclosures remain to be noticed. Regularity of form or figure di
tinguish them from *Defensive Enclosures*. They are believed to be more numer
ous than the preceding class, regular in outline, and distinguished from them
by the moats and ditches, when such exist, being in the inside. They are i
the form of geometrical figures of surprising accuracy, such as circles, square
hexagons, octagons, ellipses, parallelograms, and of various others. They ar
sometimes found *within* defensive enclosures, and doubtless had some connec
tion with the religious ideas and ceremonies of their builders. Usually there i

.n the center of this class of works a mound or elevation supposed to been the altar upon which sacrifices were offered, or which was in some used in conducting their religious services. In some instances, at least, to the writer, these central eminences or mounds when opened have ound to contain altars of stone or burnt clay, and also deposits thereon bones, ashes, charcoal and earth, all giving unequivocal indications ıction of fire upon them; circumstances clearly pointing to their use for us or sacrificial purposes. Within those *Sacred Enclosures* were doubtless ated the religious festivals of their builders, and upon those central "high ," or altars were undoubtedly performed, by priestly hands, the rites and onies demanded by their sacrificial, their idolatrous religion.

he very extensive, elaborate and labyrinthian works near Newark, Ohio, cover an area of little less than two miles square, and probably comprised iles or more of embankments, ranging from two feet to thirty feet in height, g to the class of *Sacred Enclosures*. Certainly that most interesting por- f them, formerly known as the "Old Fort," now as the "Fair Grounds," gs to this class. In the center of the circular work which encloses about acres of land, is the symbolical mound, already described as "Eagle d," which, upon being opened, was found to contain, beneath the surface, ltar," which there was good reason to believe had subserved sacrificial ses. This enclosure is formed by an embankment of more than a mile in , and of an average height of about twenty-five feet, measuring from the n of the ditch, which extends all around the inside of it, except at the ay, or entrance, on the east, which is less than a hundred feet in width, here the banks are highest and the ditch the deepest. From the gateway s *Sacred Enclosure* run parallel walls of earth a few rods apart, leading to onnecting it with other works not far off, and of the same series, consisting different forms, of octagon, oblong, and circular.

here are many *Sacred Enclosures*, but I forbear, for obvious reasons, detailed descriptions of them. I remark, however, that some Archæol- think that many classed as such were erected for and used as places of ement, where they practiced their national games, celebrated their great nal events, where they held their national festivals and indulged in their nal jubilees, as well as performed the ceremonials of their religion. And y be that those (and there are many such,) within which no central eleva- or altar occurs, were erected for the purposes last named, and not *exclusively* all,) for purposes connected with their religion; and may therefore have erroneously called *Sacred Enclosures*. Other ancient peoples, indeed all ations of antiquity probably, have had their national games, amusements, als and jubilees; and why not the mound-builders too? Notably in this d, the ancient Greeks may be named, with whom, during the period known as Z yrical age" of Greece, the Olympic, the Pythian, the Nemean and the Isth- ecame popular national festivals. And without doubt the mound- oo, had their national games, amusements, festivals and jubilees, and

FAIR GROUNDS.
10 ACRE
30 ACRES
50 ACRES
30 ACRES

within their *Enclosures* to practice, enjoy, and celebrate them. I indulged in referring to a notable case of a similar use being made of by the present race of Americans. Reference is had to one at Ohio, already described as the "Old Fort," within which are held the jubilations of the pioneers, Sabbath Schools, Grangers, and other and religious organizations, as well as Agricultural Societies and horse- associations. It was also utilized during the "great rebellion," serving of a *rendezvous*, in which a regiment of our soldiery camped for for the practice of the arts of war. Oftentimes, too, it has been for the practice of the ceremonials of our religion, such as singing, preaching; and if we have thus found it a convenient *Enclosure* in mix up apparently incongruous matters of sport, business, war, and is not unreasonable to suppose that the mound-builders found it enient for them, and possibly used it for similar incongruous

described somewhat in detail the works of the mound-builders of valley, and suggested the purposes for which they were con- ma the uses they subserved, I proceed to offer some conjectures as *Who* were the mound-builders? *Where* did they come from? *how* did they come? *How long* did they occupy the Mississippi by *what route* did they come? *When* did they leave, and *why?* they go? What was their probable *number?* *Where* are their *Who* are their successors? Were they *absorbed*, *dispersed*, or Was their obliteration effected by *war*, *pestilence*, or *famine;* or accomplished by intermingling and intermarrying *with*, and *by* surrounding tribes, peoples or races of overpowering physical and strength and numbers, or did they lose their nationality from other by other means and instrumentalities?

diversity of opinion still exists as to which of the great general of the human race the mound-builders belonged. If *that* much were known, a strong point would be gained in tracing their origin. I think, that the weight of evidence presented by Ethnologists and Craniol- assigns the mound-builders to the Mongolian division of man- gives them an intermediate position, considered physically and between the Caucasian above them and the Malay below them. this point is not indisputably settled, there are still those found among who variously class the mound-builders as of Hindoo, Hebrew, Persian; of Celtic, Egyptian, and Tartar origins. And still others they were originally Aztecs who came from some undefined Northern or from the frozen wastes of Kamtchatka, beyond the straits of Behring, Mississippi valley, and pursued their way southward. While others that they moved in the contrary direction, and peopled the great valley to north.

It is frankly admitted that authentic history furnishes reliable answers to only a few of the questions stated in the foregoing paragraph; as to the remainder we have but little else than conjectures, probabilities and speculations to aid us in reaching satisfactory conclusions respecting them. And although doubt and uncertainty are elements that must largely enter into those conclusions, I proceed to give briefly the opinions formed from the investigations I have been enabled, by the dim light afforded me, to make into those obscure but interesting matters.

It will be observed that the mound-builders are believed by some to have been of Jew-Tartar origin. Those who maintain that opinion believe them to have been descendants of the Ten Lost Tribes of the Jews. The mode, manner, probabilities and history of it will be given more in detail before I conclude this paper.* This view, I am aware, has of late years been extensively discredited, and indeed has encountered much contemptuous treatment and unfair criticism; but I am unable to see why Jew-Tartars could not as well be the first people to settle this country as any others from Europe, Asia, or Africa. The truth is, the settlement of this continent from the countries named, was practicable by two routes at least. They could cross the Atlantic by way of the Western Islands, Iceland and Greenland, as was done by the Icelandic and Scandinavian voyagers in the tenth and three subsequent centuries; or they might have made the voyage as did the expedition of Zeno from Venice in the fourteenth century; or the Welsh expedition of Madoc in 1170, A. D.; or by sailing in the direction taken by Columbus in 1492, A. D.; and they might have coasted along the Pacific to Behrings straits; or reached that point by an overland journey through eastern Asia, and thus have easily reached this continent on the north-west coast of America, after crossing Behrings straits. Behrings straits, it will be remembered, is a body of water only thirty-six miles wide, separating Asia and America. It is interspersed with islands so that, with a clear atmosphere, the navigator in crossing is never out of sight of land. Moreover, all difficulties in effecting the passage of this strait vanish at once in the light of the fact that it is frozen over every winter. In addition, also, it is not improbable that the Arctic and Pacific oceans were at one time connected by an *isthmus*, instead of being separated by a strait; and, if so, Asia and America were united, and the journey from one to the other was of easy accomplishment. There was, therefore, no insuperable difficulty in the theory under review.

Until within a few years the belief was almost universal that the mound-builders were the descendants of Asiatics. Latterly the opinion obtains to a considerable extent at least, that the Continent of America is as old, or older, than either Europe, Asia, or Africa; that, in point of fact, *this* is the "old world," and that man has existed here as long or longer, than he has anywhere else! This opinion is based upon, and strongly fortified by geological evidence, as presented by HUGH MILLER, Professors LYELL, SILLIMAN, AGASSIZ,

* See note at the close of this Paper.

and others eminent in science, who have devoted much time, great and superior talents, to the investigation of matters pertaining to as well as Geology. If this view is correct, we need not necessarily Eastern Hemisphere for the progenitors or ancestors of the mound- They may have been an aboriginal, indigenous race—"natives and born,"—ancestry and posterity. The Northmen sailed to the coast of America in 999 A. D., and on landing found human We know, therefore, authentically, that men lived here almost years ago! And it is probable that the mound-builders had, ere the acme of their glory in the Mississippi valley, and started upon of their migrating movement southward. From this it will be accord a good degree of antiquity to the mound-builders and that was from North to South, most likely. The growth of trees on whose concentric circles number six hundred, is in proof of their there is reason to believe that they were not of the first structures after their erection, the earlier growth or growths fallen and perished, long before these commenced their growth of years! From facts and circumstances pronounced conclusive, the deduces an age for most of the mound-builders' works in valley, of not less than two thousand years!

authority finds further proof of the antiquity of these works from none of them occur on the lowest formed of the river terraces the subsidence of the western streams; and as there is no good their builders should have avoided erecting them on that terrace, raised them promiscuously upon all the others, it follows, not un- that this terrace has been formed since these works were erected — supported by the important fact, that some of them have been in by streams which have since receded for half a mile and upward, under no present possible rise, from rains or other natural cause, the works again. Upon these premises, the time since the streams in their present courses may be divided into four periods, corres- the four terraces which mark the eras of their subsidence, of which last and longest (since the excavating power of the streams diminishes of their depth increases) has elapsed since the mound-builders n the Mississippi valley.

vidence in proof of the southerly movement of the mound-builders, the fact of their works being traced from the Lakes of the North to of Mexico, and that their contents indicate, as we go southward, an knowledge of the useful arts. Their pottery near the Lakes was mproves as we go South. In the North it was neither polished nor the Ohio it was polished or well glazed, and the vessels were better Ornaments of silver are seldom if ever found near the Lakes, while nd southern Ohio they have been abundant,—and where, also, are found useful and ornamental specimens of their work. My

evidence is not conclusive, but is urged merely as tending to raise a probability.

That the mound-builders were a numerous people, does not admit of a Works so elaborate, so gigantic, could not have been erected by a people nificant in numbers. Probably a hundred millions of the mound-builde lived and died during the centuries that these extensive works were in of construction throughout the Mississippi valley!

That the mound-builders were also an agricultural people is quite They were too numerous to live by the chase, upon the products of the and lakes, or upon the spontaneous yieldings of the earth, or upon al bined. Of necessity, therefore, they must have been tillers of the soil.

That they were also the subjects of a single strong government, is probable. The American *Cyclopedia* justly says that "the mound-builder have been not only a numerous and wide-spread race, as shown by the and magnitude of their works, and the extensive range of their occurrence that they were essentially homogeneous in customs, habits, religion and ment, as appears from the great uniformity their works display, not onl respect of position and form, but in all minor particulars; and that the common to all the remains, identify them as appertaining to a single system, owing its origin to a family of men moving in the same genera tion, acting under common impulses, and influenced by similar causes."

That the mound-builders had some military skill, and were not some acquaintance with mathematics, is quite evident. Their works show

They were somewhat skilled, too, in working metals. The articles o and ornament made of silver and copper, found in their works, are testimony on this point.

They were not a savage people. The general features of their work that they had made no inconsiderable progress in the direction of

They were doubtless a superstitious people. The labor bestowed upo what were obviously places of worship, and in some way connected with thei religion, shows their tendency in this direction. They doubtless offered u animals in sacrifice as a part of their religious ceremonies, and it may be tha human sacrifices were not wholly unknown among them. Prisoners of war ar thus disposed of sometimes by peoples having the grade of civilization o mound-builders. The evidence is not conclusive, however, that captive thus utilized by them, although the sacrificial character of their religion is clearl established. The late Dr. FOSTER hesitates not to say that they were worshipper of the elements,—that they worshipped Sun, Moon, and Stars—and that the offered up human victims as an acceptable sacrifice to the elements. The altars and charred or calcined bones fully satisfy him of the correctness of h opinion. That they were Fire Worshippers seems probable Dr. FOSTER had n doubt of it.

What became of them—through what agencies did they become extinct Were they absorbed by surrounding peoples? Or did they migrate to

"under the combined attractions of a more fertile soil and more genial
" or did they succumb to the victorious arms of a more war-like race,
they yield to a terrible famine, or perish of some fearful pestilence?
ly they "went out" in one of those ways. More likely they passed through
races preceding the Toltecs, and ultimately came within the domain of
luring the seventh and succeeding centuries as the Toltecs, in Anahuac,
and after remaining there until the eleventh century, most of them
on in their south-western movement into Central America, where
those cities whose ruins were brought to the notice of the world by
JOHN L. STEPHENS, a quarter of a century ago. Or were they the
who entered Anahuac, (Mexico,) from the north-west, towards the
he twelfth century, (about the year 1170, A. D.) Or is it not most likely of
heir first appearance as a historic people on this continent was as the Aztecs
he valley of Mexico in the year 1200, A. D., and during the early years
hirteenth century; and who, at the time of the Spanish conquest by
hree centuries later, were occupying the plateau of Anahuac, or Mexico,
ttained, in the reign of MONTEZUMA II., to a degree of civilization far
of any peoples or races then in North America?

give herewith some facts which render plausible the Hebrew
artar theory of the origin of the mound-builders.
reader of the Scriptures will remember that after the death of Solomon,
Jewish Tribes separated and formed two distinct governments; the
udah and Benjamin, under REHOBOAM, the son of SOLOMON, established
of Judah at Jerusalem; and the other tribes, ten in number, under
organized themselves into the Kingdom of Israel, at Samaria. In the
B. C., which was three hundred and fifty-four years after the estab-
of the Kingdom of Israel, "SHALMANEZER, the king of Assyria, besieged
and carried the ten tribes into Assyria, and placed them in Helah and
by the river Gozan, and in the cities of the Medes, and thus ter-
the Kingdom of Israel, in Judea." In Assyria they were principally
by those among whom they settled; but Sir WILLIAM JONES and Dr.
CLARKE hold that some of these "lost tribes" originated the Afghans of
If so, they could have descended the Euphrates into the Persian Gulf,
coasted around China, India and Japan, to Behrings straits, or reached
by crossing Tartary and Siberia.

CHARLES FORSTER, an English author of great learning, in his late
on "One Primeval Language and Ancient Inscriptions," asserts of the
Tribes" that in process of time, "having greatly multiplied in Assyria, a
of them gradually migrated beyond the borders of Media eastward, in
of Chinese Tartary, where they were a peaceful, pastoral people,
versed in the laws of MOSES." He also asserts the existence of a great
colony among the Chozan Tartars, and that a large number of those
became Jews or Israelites, who professed belief in the Jewish faith, and

practiced the rite of circumcision. He further asserts that "many portions o Tartary abound in landmarks of Hebrew colonization, and that the traveler i continually walking among the foot-marks of a Hebrew population." Th nomenclature of Tartary, as seen in the names of mountains, rivers, and citie corroborates the foregoing. The heathen geographer PTOLEMY, who wrote the first century before Christ, gave the names of Israelite tribes living ir mountains of Chinese Tartary. Thus are the "lost tribes" traced from Assyri to Tartary, in the direction and on the line of travel towards Behring's which they may have ultimately reached, and crossed to the American Conti nent. The journey from Assyria to America might thus have been made, b portion of the descendants of the "Ten Tribes," in less time than it took ancestors to make the journey from Egypt to Canaan; but it would not b conclusive against the theory in question, if it took ten times as long. But th Jews might have reached our Continent by voyaging westward instead of trav eling eastward. The learned author just quoted, asserts that NEBUCHADNEZZE when besieging Tyre, sent forth expeditions by sea and land, to sweep th Phœnician colonies along the coast of Africa and in Spain, and that a larg body of Jews accompanied them as emigrants, for the purpose of settling i Spain. Thus as early as six hundred years before Christ, we find a colony in Western Europe. Toledo, the oldest city in Spain, was built by Jew and the oldest building in it is a Jewish Synagogue. From thence, by way the Western Islands, Iceland and Greenland, the voyage to America could a readily have been made by Jews, as by the expeditions that we know subse quently crossed the Atlantic.

Some have supported this theory by arguments drawn from the similarity in sound alleged to exist in the pronunciation between words in the language of the Jews, and those found in the various dialects of our aboriginal tribes, who are supposed to have descended from the mound-builders. The arguments are supposed to be strengthened by the affinities said to exist between the Hebrew language and the language spoken by the Tartar tribes in North-eastern Asia, among whom Jews were known to have dwelt in considerable numbers.

The mound-builders' method of burial, was practiced by the Jews in very ancient times. Says the sacred historian, "and they took ABSALOM and cast him into a great pit in the wood, and laid a great heap of stones upon him." Dr. ADAM CLARKE, the eminent biblical scholar and commentator, says! "this was the manner of burying in Judea, the *heap of stones* being designed to perpetuate the memory of the event." ACHAN was similarly buried; so, also, was the captive king, whose history is given in the eighth chapter of Joshua.

Altars of stone and earth, such as the mound-builders constructed for religious sacrifices, were common among the Jews, anciently, and were used for similar purposes. MOSES commanded the people of Israel "to build an altar unto the Lord; an altar of stones." In the eighth chapter of Deuteronomy, it is said that "Joshua built an altar of *whole stones*, over which no man hath lifted up any iron, whereon they offered up burnt offerings." The command to

Moses was, "An altar of earth thou shalt make unto me, and shall sacrifi thereon thy burnt offerings, and thy peace-offerings."

Jeremiah, the prophet, speaks of the Jews "setting up way-marks, an making to themselves *high places*." Indeed, "high places" are very often mer ioned in the Jewish scriptures, as monuments commemorating persons an events; also as places of sepulture, and sacrificial altars. The Jews, says D KE, "offered sacrifices on their *high places*, but King Hezekiah remove because they were incentives to idolatry." Among the Jews of ancie there was a great proneness to idolatry, as is clearly developed by the hi of this remarkable people. They strangely intermingled religious worshi to the Mosaic ritual, with the rites of idolatry. Even Solomon n tolerated idolatry in Judea, but he established it, and consecrated to th orgies of the heathen one of the hills of Jerusalem, in full view of th temple of his own building, which he had himself dedicated to the wo of Jehovah! And similar propensities were manifested by the moun They built stone mounds—like the Jews they piled up "great hea stones!" Like the Jews also, they erected altars for sacrificial or religio And they, too, erected mounds or tumuli, corresponding to the "hig " of the Jews. They also erected those various structures or monumen events—works upon which to offer sacrifices, and for purposes and worship—at least this seems probable—just as was the practice Jews. Jacob erected a pillar of stones in order to perpetuate the recolle of a dream he had, where he reposed when journeying to visit Laban. *f stones* was raised on the spot where, many years afterwards, he parte his brother Esau, which was to be the limit that neither could pass witl being a trespasser on the other. When the Israelites crossed the Jordan priest raised a *pile of stones* which were brought from the bed of that river Gilgal was *a heap of stones* to commemorate the event of the Israelite of the Jordan.

The eminent author of "*Cruden's Concordance*," who had devoted himse , a long lifetime, to investigations into the history of the Jews, says Great *heaps of stones*, raised up for a witness of any memorable event, and t the remembrance of some matter of great importance, are the mos monuments among the Hebrews. In those early days, before the use those monuments served instead of medals, inscriptions, or histories. Illustrations he then refers to a monument erected upon Mount Gilead, b and Laban, in memory of their covenant—to that built at Gilgal b shua—and to another raised near the Jordan by the Israelites.

Shiloh, Bethel, Jerusalem, and many other places where the Jews general for worship and sacrifice, were situated on hills or "high places"; and th and "high places" of the mound-builders, were certainly used f purposes. Charcoal, ashes, calcined bones, and other indications of th use of fire in our mounds, clearly point to the sacrifices that were offered, b way of religious worship upon them, just as the "*high places*" of the Jews wer

used by them. The mounds of the Mississippi valley correspond with the "*high places*" of Judea, and were used for the same chief purpose, respectively by the mound-builders and the Jewish people! They served the same purpose in the conduct of their religious ceremonies, *to mound-builder and to Jew!*

The theory above outlined finds ten tribes of the Jews captives in Assyria, in 721 B. C., or about 2600 years ago. A portion of them, several hundred years thereafter, are found to have intermingled with the Tartars, to a considerable extent, and to have probably got well along in their movement towards the American Continent, on its North-west Coast, either across Independen Tartary and Siberia, or down the Euphrates and along the coast; or by way of the Mediterranean and Atlantic, arriving some centuries later, probably more than 2000 years ago, when they started upon their great migratory movement of 1500 years, to appear upon the page of history in the year 1200, A. D., as the Aztes of Mexico!

THE HUMMING-BIRD MOTHS, OR SPHINX.

These singular and beautiful little insects so closely resemble the real humming bird as they hover in the air before a flower, that they have been mistaken for a small species of that charming little bird. The sphinxes constitute the second or crepuscular division of the Order Lepidoptera, which corresponds with the old genus sphinx, divided into three sections, called sphinx, ægerians, and glaucopidians.

This division is also called hawk moths, from their hovering and powerful flight. The name sphinx was given them from the habit the larva of the typical section has of sitting with the head and fore part of the body raised in an upright position, bearing a fanciful resemblance to the Egyptian Sphinx.

The humming bird moths fly in the early morning or evening twilight, although some species are seen at all times of the day in the brightest sunshine. They have the antennæ thickest in the middle or towards the ends, but the tips always pointed, and generally hooked. The wings are long and pointed and adapted to powerful flight. They are retained in a horizontal or slightly inclined position, by a bristle or bunch of stiff hairs on the shoulder of each hind wing, which is secured by a hook on the under side of each fore wing, the upper ones covering the lower. There are two pairs of spurs on the hind legs. Their bodies are thick, of large size, and slightly pointed behind. The tongue is long, narrow, and extensile, kept rolled up except when used to obtain the honey from flowers, when it is unrolled and extended into the flower. Sometimes the tongue is longer than the body. Many species of sphinx are of such large size and of such brilliant colors as to be easily mistaken by the casual observer for a humming bird. As before stated, this division of the Lepidoptera is divided into three sections: first, the sphinxes proper, which hover in the air while feeding; second, the ægerians, whose flight is swift but not pro-

and they generally alight when feeding. They have a tuft at the en
body which they expand like a fan; and third, the glaucopidians, so cal
from the blue color of the eyes of some of the species; have the anten
feathered on each side, fly by day, and alight while feeding.

The humming bird moths all have sixteen legs in pairs. The caterpil
of the sphinxes feed upon the leaves of plants, upon which they are fou
Those of the ægerians, otherwise called borers, live concealed within the st
r roots of plants and live upon their interior substance. They are soft, whi
small, and make cocoons of small pieces of wood cemented together
matter. The chrysalids are brown; the edges of the abdominal s
have rows of short teeth, by which they cut their way out of the co
the wood. The caterpillars of the glaucopidians are slender, with a
hairs in tufts. They eat the leaves of plants, make a cocoon of s
the chrysalids are round at one end and tapering at the other. They h
eeth.

There are many species of the humming bird moths, but we can notice
ew of the most prominent ones found in the United States. They all mak
noise in their flight, and in the typical division Sphinx hover
n the air before the flower from which they extract the nectar with t
extensile tongue. The species of the other two sections have a sim
but alight when feeding. The description of the two species given
ionth, is from the pen of Prof. W. SAUNDERS, in the Ontario Repor

THE ACHEMON SPHINX.

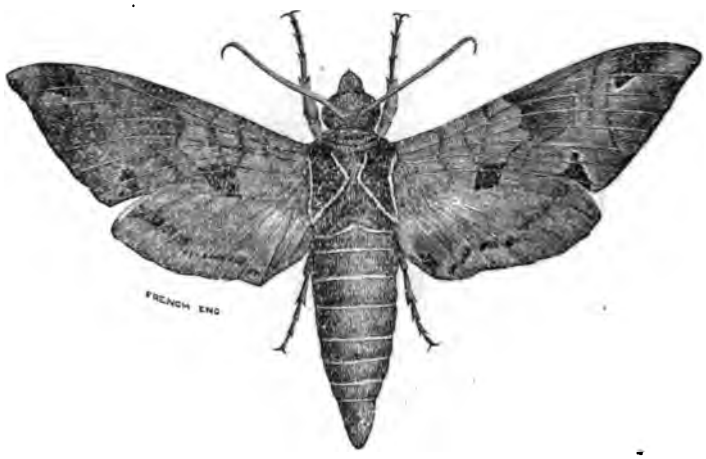
(*Philampelus Achemon.*)

BY PROF. W. SAUNDERS, LONDON.

The caterpillar of this species is a formidable looking creature, measuri
when full grown, if at rest, about three inches, and, when crawling, about t
nd a half inches. While young, as this larva feeds singly, it does not att
nuch attention, but, as it approaches maturity, it consumes in a short ti
arge quantities of leaves, rendering long branches of the vine quite leafless.
s usually met with of full size late in August, and feeds on the American
(*Ampelopsisquinque folia*) as well as on the grape vine. The following dese
ions of the larva and perfect insect are compiled chiefly from Mr. Riley's sec
report on the insects of Missouri.

The largest segment in the body of the larva is the third behind the he
the second is but half its size, and the first still smaller; and, when at rest
usually withdraws the head and the two next segments within the third. T
caterpillar varies much in color; when young, it is usually green, with a l

slender, reddish horn, rising from the last segment but one, and curving backwards. When full grown, the general color is sometimes green, but more frequently a pale straw color, or reddish brown deepens at the sides, and finally merges into a rich brown. A broken line of brown runs along the back, and another unbroken, with its upper edge fading gradually, extends along each side. It has six scalloped cream-colored spots on each side, and is covered more or less with minute spots, which are dark on the back, but light and annulated at the sides. There are also from six to eight transverse wrinkles on all but the thoracic and caudal segments. The head, front segments and breathing holes incline to flesh color, while the prolegs and caudal plate are deep brown.



When full grown, and about to transform to a chrysalis, the color of the worm often changes to that of a beautiful pink or crimson. It then descends to the ground, and burrows underneath, and undergoes its change there within a smooth cavity. The chrysalis is of a dark shining mahogany brown color, roughened, especially on the anterior edge of the segments in the back.

The moth (See figure) is of a brownish grey color, variegated with light brown, and with the dark spots shown in the figure deep brown. The hind wings are pink, with a dark shade across the middle, still darker spots below this shade, and a broad grey border behind. It is usually single brooded, the chrysalis remaining in the ground through the fall, winter and spring months, and producing the moth towards the latter part of June.

This insect has rarely presented itself in sufficient numbers to prove alarming to the vine-grower, either here or in the United States Indeed, with us, it has hitherto been a rare insect; nevertheless, since some usually rare insects occasionally appear in comparative abundance, we have thought it best to present our readers with a history of the species, so that all may be able to recognize it. Should it at any time prove troublesome, its large size makes it so conspicuous, that it might be easily controlled by hand picking.

THE ABBOT SPHINX.

(*Thyreus Abbotii.*)

BY PROF. W. SAUNDERS.

We have never yet met with the larva of this insect, but have seen speci- of the moth, which were captured in the neighborhood of Hamilton, Ont. some of our readers will have met with it. Figure shows the moth. following description of this species occurs in Mr. Riley's second report, alluded to, which we shall take the liberty of copying:

"This is another of the large grape feeding insects occurring on the culti- and indigenous vines, and on the Virginia Creeper, and having, in a full larva state, a polished tubercle, instead of a horn at the tail. Its habitat

en by Dr. Clemens as New York, Pennsylvania, Georgia, Massachusetts, Ohio; but, though not so common as the Sphinx moths previously described, it is often met with both in Illinois and Missouri. The larva varies con- in appearance. Indeed, the ground color seems to depend in a on the sex, for Dr. Morris describes this larva as reddish brown, with patches of light green, and expressly states that the *female* is of a reddish-brown, with an interrupted dark brown dorsal line, and trans- striæ. I have reared two individuals, which came to their growth about last of July, at which time they were both without a vestige of green. The color was dirty yellowish, especially at the sides. Each segment was ed transversely with six or seven slightly impressed fine black lines, and with wider non-impressed dark brown patches, alternating with other, and giving the worm a checkered appearance. These patches more dense along the subdorsal region, where they form two irregular lines, which, on the thoracic segments, become single, with a similar line hem. There was also a dark stigmatal line, with a lighter shade above and a dark stripe running obliquely downwards from the posterior to the portion of each segment. The belly was yellow, with a tinge of pink the prolegs, and the shiny tubercle at the tail was black, with a yel- ring around the base. The head, which is characteristically marked, and

by which this worm can always be distinguished from its allies — no matter what the ground color of the body may be — is slightly roughened and dark, with a lighter broad band on each side, and a central mark down the middle, which often takes the form of an x. This worm does not assume the common Sphinx attitude of holding up the head, but rests stretched at full length; though, if disturbed, it will throw its head from side to side, thereby producing a crepitating noise.

"The chrysalis is formed in a superficial cell on the ground; its surface is black and roughened by confluent punctures, but, between the joints, it is smooth, and inclines to brown; the head case is broad and rounded, and the tongue case is leveled with the breast; the tail terminates in a rough flattened wedge-shaped point, which gives out two extremely small thorns from the end.

"The moth appears in the following March or April, there being but one brood each year. It is of a dull chocolate or greyish brown color, the front wings becoming lighter beyond the middle, and being variegated with dark brown, as in the figure. The hind wings are sulphur-yellow, with a broad dark brown border, breaking into a series of short lines, on a flesh-colored ground, near the body. The wings are deeply scalloped, especially the front ones, and the body is furnished with lateral tufts. When at rest, the abdomen is curiously curved up in the air."

Should this worm at any time become sufficiently numerous to prove destructive — which is scarcely probable — we could not suggest a better remedy than that given for the preceding species, namely, hand picking.

CRYSTALLOGRAPHY.

BY W. C. CHAPMAN, M. D.

The changes which are continually taking place in the Universe, are in accordance with definite laws; these laws are immutable; the same conditions being presented, the results which follow will in no wise differ from those observed under similar circumstances at a previous time. This is true whether *animal* or *vegetable life* or *inanimate nature* is the subject of observation. Every atom of matter and element of force, when created, were given their specific work to perform, restricted in all cases, by laws which can never be violated.

The mind of man undertaking to investigate these laws, is successful in building for himself a fabric, which he calls a science; if truthfully named he says, thus far, "I know." There is a region beyond which no intellect can penetrate; no matter in what direction investigation may be undertaken, there is a boundary where it plainly reads, "Thus far and no farther." It is true that year by year this boundary line is being extended farther and farther into the supposed region of the unknowable, and it seems at times almost possible to brush away all barriers in the way of perfect knowledge, but suddenly the real-

sense of utter ignorance crowds back upon the intellect as it stands
and defeated, in endeavoring to comprehend that which is only known
Him who created all things. "Let me not, however," says one, "be under-
:o imply a belief that man cannot attain to any absolute scientific truth
I believe that he can, and I feel that every great generalization brings him a
nearer to the promised goal. Moreover, I sympathize with that beautiful
of Oersted, which he expressed in the now familiar phrase, "*The laws of*
are the thoughts of God;" but, then, I also know that our knowledge o
aws is as yet very imperfect, and that our human system must be at the
but very partial expressions of the truth. Still, it is a fact, worthy of our
attention, that in each of the physical sciences, as in astronomy, the
e great generalizations which have marked its progress have included
expanded rather than superseded those which preceded them. Through
great revolutions which have taken place in the forms of thought, the ele
of truth in the successive systems have been preserved, while the erro
been as constantly eliminated; and so, as I believe, it always will be, until
ast generalization of all brings us into the presence of that law which is
:he thought of God."*

Scientists of our day have succeeded in determining many facts which have
:n darkness since the creation, and daily, little by little, each one is
his mite to the accumulation of demonstrable truths. The chemist, by
of established laws of matter, is now able to weigh an atom or give
dimensions of a molecule, although the mind cannot conceive of a body so
small. Thus may we conceive of them, as has been expressed by a
writer.† "If we conceive a sphere of water as large as a pea to be
to the size of the earth, each molecule being magnified to the same
the magnified structure would be coarser-grained than a heap of small
shot, but less coarse-grained than a heap of cricket balls." When we con
each of these molecules as composed of several atoms, the mind cannot
their existence. And yet it is possible to prove that all matter is
more than an intimate union of these minute particles, and that they
be separated, reunited, weighed or their properties investigated, as readily
f they were plainly visible. It is the study of the physical laws of molecules
we consider when studying the natural forms of various substances.

Avogadro, only little more than half a century ago, enunciated a law, a
by patient investigation, which is the foundation upon which has been
the *modern chemistry*. Recognizing a molecule as being but a small
of matter, which cannot be subdivided without changing its chemical
he takes this particle as a representative of all matter, and con
the laws which govern it as applicable to all objects. "EQUAL VOLUMES
ALL SUBSTANCES, WHEN IN THE STATE OF GAS, AND UNDER LIKE CONDITIONS
CONTAIN THE SAME NUMBER OF MOLECULES."

* The New Chemistry, p. 10.
† Sir William Thompson.

The terms "atoms" and "molecule" have often been used as synonymous. In the consideration of our subject, there should be a clear understanding of the true meaning of each word. A molecule may be considered as a compound atom, in which the characteristics of each combining atom is lost, resulting in an entirely new substance. Thus water is composed of molecules of water which may exist in either solid, liquid or gaseous states, but each molecule of water is made of atoms of two invisible gases — hydrogen and oxygen — which in a separate condition have never been obtained in other than a gaseous state. Let it be observed that in the study of *Crystallography* we have nothing to do with the ultimate atoms of matter, but that we must consider the molecules alone, as being that portion of matter which is governed by physical laws, and leave the atom to be studied, as a question of interest to the chemist alone.

All substances must exist in one or more conditions, either solid, fluid, or gaseous. In all cases surrounding circumstances determine in which form they are presented. Some substances are only known in one form as hydrogen, which is always gaseous when uncombined. Alcohol, though never solid, readily evaporates, and that most common of all bodies, water, though under usual circumstances it remains a liquid, is readily solidified, forming ice, or becoming vaporized, is driven off into steam.

The force which operates in all cases to determine which condition a substance is to assume, is known as *cohesive force*. In the gaseous state this force is *nil;* the molecules tend to separate farther and farther from each other, and the particles are restrained from separating by the vessel which surrounds them; thus it has been said that the walls of the glass vessel which encloses the gas is being continually bombarded by the invisible molecules as they endeavor to free themselves from the restraint. The wonderful power with which this action is carried on is well displayed in the force with which the steam engine accomplishes the great work required of it.

In the condition of fluids the force of cohesion begins to assert itself; the molecules of matter are no longer free to fly off in all directions, but the tendency is to come together; one molecule attracts another, and having once united, separation cannot take place without an introduction of a force sufficient to overcome that already exerted. The molecules may move readily among themselves, but in no case do they separate. Conforming themselves to the shape of the vessel in which they are placed, fluids can have no form of their own. When unrestrained, like solids, they are operated upon by gravitation, but being free to move, they flow from place to place, always seeking a lower level.

A solid body is one in which the cohesive force is exerted to such a degree that definite form becomes possible. Mechanical violence may be sufficient to divide and subdivide until the substance is reduced to impalpable powder, and yet the microscope will reveal the particles in all their integrity, each minute portion remaining unchanged in character. This division may be carried further. Sugar may be dissolved in water and entirely disappear to the eye or strongest glass, but still it remains sugar, with all the chemical and physical properties of

sugar; it is merely subdivided by the water and may be reclaimed unchange by simply removing the water from it.

Almost all substances, which may exist in a solid state, have a tendency t assume a certain definite form, under circumstances which are favorable to suc formation. This is due to the force of cohesion acting upon the molecul which enter into the formation of various bodies. Why in one case they shoul to arrange themselves in the form of the cube and in another that of th we can never hope to discover. This law of nature must ever remai God, but it is possible to arrange and classify these formations in accor with the laws which are known to obtain, when any body is under co and progress in this branch of science has been made to such a hat we are pleased to study it under a name of its own, the *science* y.

In nature all bodies, whether belonging to the organic or inorganic kin have a form by which they may at all times be distinguished the one fro ɔtner. This peculiar form is as constant in all cases as any other characte Every-day-life illustrates the fact as it exists in either animal or vegetab where like always begets like; but it is not so plainly understood th matter is always prone to appear in a form that is peculiarly its ow vould seem in one case that the living germ possessed all that, which, by d would assume a proper form, but in the inorganic kingdom there element of life to develop to perfection. Why should the molecules of sodium always arrange themselves into cubes, and those of nati ɔe found in pyramids.

All solids, with scarcely an exception, are crystalline in structure. It hat many substances may be found, which exist in more than one form charcoal may be called an amorphous condition of carbon. This eleme s known in the beautiful crystalline form the diamond, and again in th prisms of graphite. There are, therefore, two forms in which all sul may occur, the one crystalline and the other amorphous — the form composed of crystals, and the latter having no definite form or structur

A crystal has been defined as "a piece of matter that, by the action forces, has assumed a definite geometrical form of some kind, wi faces."—(*Chambers' Encyclopædia.*) The most beautiful specimens are found among the natural minerals, and many may be formed art n the laboratory. In order that the terms applied to the various par a crystal may be properly understood, let it be remembered that the li by the junction of any two planes, is called an edge, and the union wo edges of the same place forms an angle. Where three or more plan ieet, is called a solid angle. An axis of a crystal is an imaginary line, passi hrough the center from one plane to the one opposite, or from an angle to th ɔne opposed to it. There may be three or more axes all intersecting at th center of the crystal around which it is built.

The formation of crystals or crystallization generally takes place conditions, either from *solution*, *fusion* or in passing from a *gaseous* to *state—sublimation*. Solid bodies, however, may undergo a change in molecular conditions without the interference of either the above agencies is frequently demonstrated in the change of structure in rail car axles and metallic objects subjected to continued strain or jar.

The property that water and other liquids possess of dissolving more c substance at a high than a low temperature enables the chemist to procur beautiful specimens of various crystals; by evaporation of a solution, th stance held dissolved will be deposited as crystals, and the slower sucl ration takes place the larger and more perfect will be the resulting crystals.

If sulphur or bismuth be heated to fusion, and allowed to cool sufficient for the formation of a crust upon the surface, on breaking through this cru and pouring out the remaining liquid, beautiful crystals will be found, ramifyin in all directions. If iodine or camphor be vaporized, crystals will be forme by placing a cool disk over the ascending vapor.

Crystals have the property of being split in certain directions, showing th there is a certain form of internal structure; these lines of separation are def nite in all forms of crystals, and are generally parallel to the planes of on more axes. This property is called cleavage. Mica readily shows this while the beauty of the cut diamond is alone due to the possibility of the nat ture in the line of cleavage. There are some notable exceptions to this rul as in quartz where it has not yet been discovered.

Many substances when crystallizing, from a watery solution, have th property of absorbing, if it may be so called, a certain portion of water. such is the case can be easily proven, by its liberation on application of hea This water is known as the *water of crystallization*. The state in which it enter into the formation of the crystalline body is one in which it nowhere else exists that is as a solid. In ice we may, as some one has said, consider water in solid form when uncombined with other substances, as it occurs in the crystal a solid water in combination.

Although it would seem that there are endless varieties of form in whicl crystals are found, still it is possible to reduce all these forms to six groups, and all crystalline bodies may be classed as belonging to one or the other of these groups. It is true that very few bodies found in nature are perfect examples c any one system, for surrounding circumstances have always an influence in either perfecting or otherwise modifying the process of crystallization. There i always found an approach to certain definite forms in all bodies, and these forms are so characteristic of every substance that the expert is able to discover the nature of the substance by the group of crystals to which it belongs.

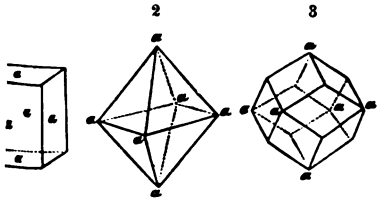
Some bodies have the power of assuming more than one form, and may therefore be classed as belonging to several systems. Carbonate of lime as calcite crystallizes in rhombohedrons, but as aragonite it crystallizes in trimetric prisms. The diamond belongs to the cubic system, while graphite, another form

occurs as a hexagon. This property of presenting more than one is called *dimorphism.*

There are some substances having the same form that have the property of each other, without changing the characteristic figure. Such bodies *isomorphous.* When solutions are made of any two isomorphous substances mixed together, they can never be again separated by crystallization; the crystal will in all cases be composed of the two isomorphous substan- A common example of such a body is found in alum, which is a com- consisting of the sulphate of alumina and potash, two isomeric bodies. determining the relations existing between the planes and axes of crys- crystalline substances may be considered as belonging to one of six or systems. The number, relative length and position of these axes will determine the number and position of the planes of a crystal, and so t its characteristic figure. The six systems into which all crystals are are the monometric, dimetric, trimetric, monoclinic, triclinic, and

FIRST CRYSTALLOGRAPHIC GROUP.

monometrtc, octahedral, or *regular cubical system.*—In this system we axes of equal length, crossing each other at right angles. The prin- by which this system is represented, are the cube (1), the octahedron the rhombic dodecahedron (3).



a a—axes.

The cube or hexahedron, is bounded by six equal sides. The angles formed are 90 degrees. As seen by the letters, the axes join the centers of the opposite planes. In common with all the other forms of this class, the faces must necessarily be equal, as the axes are of the same length.

The octahedron is bounded by eight equilateral triangles. The axes join opposite solid angles. It is like two four-sided pyramids placed base to

The rhombic dodecahedron is bounded by twelve equal rhombs. The axes the opposite four-sided solid angles.

In addition to these three principal forms of the monometric system, may mentioned the *three-faced octahedron,* the *deltohedron,* and the *six-faced octa-* *on.* The six forms given above are symmetrical and *whole-sided,* or *holo-* *al.* These may be modified again so that the planes form figures of very rent character. These are termed *hemihedral forms of the monometric* *m.* We will only take the space to mention them here. The *tetrahedron, trigonal dodecahedron,* the *deltoid dodecahedron,* the *six-faced tetrahedron,* the *ezohedron,* and the *pentagonal dodecahedron.*

The following are examples of this system of crystallization: Alum, diamond, galena, gold, iron, lead, salt, and silver.

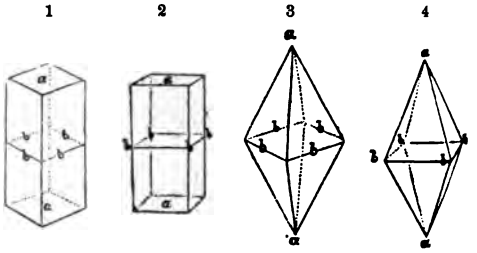
SECOND CRYSTALLOGRAPHIC GROUP.

The *dimetric*, *square prismatic* or *pyramidal*, is the second of the graphic systems.

We have in this class of crystals, three axes at right angles to each two of which are of equal length, and the third either longer or shorter the other two; this one is called the principal axis, the others the axes.

The most frequent and important forms of this system are the two *prisms* on *a square base*, and two *double four-faced pyramids*. The first of have the lateral or secondary axes terminating in the central point of sides (1); in the second right prism the axes terminate in the edges (2); the difference is seen in the two pyramids (3 and 4).

A modification in the form of the pyramids exist when the principal axis *a-a* is shorter than the secondary. In such case it will appear as a flattened pyramid. It must be remembered that in all cases the principal axis must be vertical.



a a—principal axis.
b b—secondary axes.

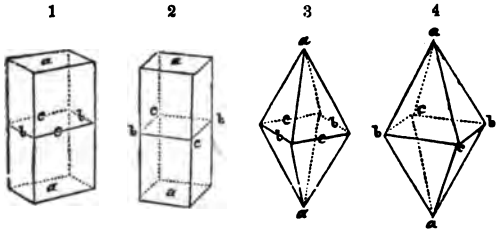
The following are the best known minerals which belong to the pyramidal system:

Apophyllite,
Idocrase, (pyramidal garnet),
Tin, (native stannic oxide),
Zircon.
Calomel,
Stotzite, (tungstate of lead),
Towanite, (copper pyrites),

THIRD CRYSTALLOGRAPHIC GROUP.

The third crystallographic system is the *trimetric*, *rhombic*, or *prismatic*. this division we have three axes, but all of unequal length, crossing each at right angles. Any one of these may be taken as the principal axis, and selected is placed vertically. The following figures show the principal belonging to this group:

The *right rectangular prism* (1); the *right rhombic prism* (2); the *rectangular-based octahedron* or *pyramid* (3); the *right rhombic-based* or *pyramid* (4).



a a—principal axis.
b b, c c—secondary axes.

The following minerals to this system:
Anglesite, (sulphate of lead),
Aragonite, (carbonate of lime),
Baryte, (sulphate of barytes),
Bismuthine, (sulphide of
Celestine, (sulphate of strontium),
Cerussite, (carbonate of lead),
Chrysoberyl.

iosphate of iron),
.lphate of magnesia),
ılphate of potash),
·lphate of zinc),
nosphate of copper),
.., ,rey oxide of manganese),
:·ate of potash),
'-isulphide of arsenic),
hloride of copper),
'oxide of zinc silicious),
.., :arbonate of strontium),

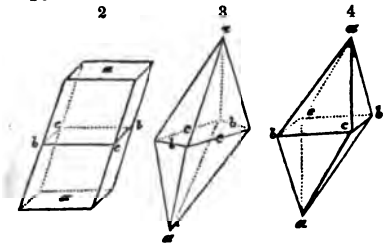
.... ,ulphate of soda),

.., ,ungstate of iron).

FOURTH CRYSTALLOGRAPHIC GROUP.

.... or *oblique prismatic* is the fourth crystallographic system. hree axes which may be of equal or unequal lengths; the two .... are at right angles to each other, the principal axis being per- · but inclined, and therefore oblique to the other.

.... figures represent the most common forms of the crystals of T... *rectangular prism* (1), the *oblique rhombic prism* (2), the ... *octahedron* or *pyramid* (3), the *oblique rhombic-based* or *pyramid* (4).



a a—principal axis.
b b, c c—secondarg axes.

We mention the following minerals as belonging to this group:

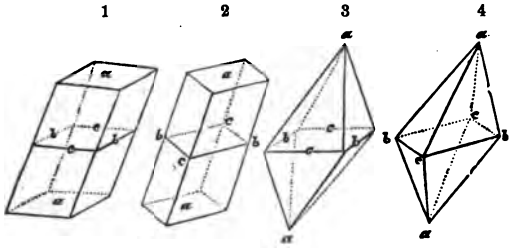
Briberite, (sulphate of cobalt),
Chessylite,(blue carb. of copper),
Felspar,
Glauberite,
Gypsum, (sulphate of lime),
Kermes, (red antimony),
:, (oblique prismatic arseniate of copper),
.nite, (chromate of lead),
:, (cupreous sulphate of lead),
(phosphate of copper),
e, (green carbonate of copper),
..rite, (sulphate of iron),

.e, (sulphate of soda),
ı, (carbonate of soda),
.r, (red sulphide of arsenic),

Tincal, (borate of soda),
Vivianite, (phosphate of iron),
Whewellite, (oxalate of lime).

FIFTH CRYSTALLOGRAPHIC GROUP.

The fifth system is called the *triclinic*, *anorthic* or *double oblique prismat system*. Here we again have three axes of either equal or unequal lengths, an all oblique to each other. As the name "anorthic" implies, this group of crystal are all wanting in symmetry, and on account of their great irregularity a studied with much difficulty. The principal forms are modifications of th fourth system previously considered. That is, we have two oblique prisms an two oblique octahedrons—the difference is in the obliquity being doubled Thus the following figures show the *double oblique rectangular prism* (1), the *double oblique rhombic prism* (2), the *double oblique rectangular-based octahedron* o *pyramid* (3), and the *double oblique rhombic-based octahedron* or *pyramid* (4).



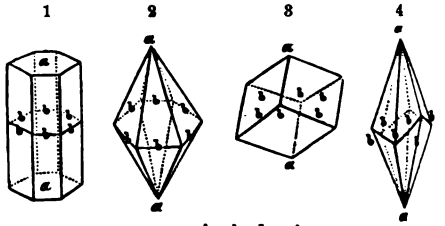
a a—principal axis.
b b, c c—secondary axes.

There are very few natura minerals belonging to this system. The following are most frequently met with :

Blue vitriol,(sulphate of copper),
Labradorite, (labrador felspar),
Sassoline, (native boracic acid),
Nitrate of bismuth,
Quadroxalate of potassium.

SIXTH CRYSTALLOGRAPHIC GROUP.

The sixth and last crystallographic system is termed the *hexagonal* or *rhombohedral*. Heretofore the forms of crystals have all presented three axes: in this sixth class we have four axes—three of which lie in the same plane, are secondary and equal, being inclined to each other 60 degrees; the principal axis is at right angles to these, and may be of any length. This system is very important, being met with in many beautiful native minerals. The principal forms of this group are the *hexagonal prism* (1), the *hexagonal pyramid* (2), the *rhombohedron* (3), and the *scalenohedron* (4).



a a—principal axis.
b b—secondary axes.

The examples of these forms are readily found in nature. Among the most common may be mentioned :

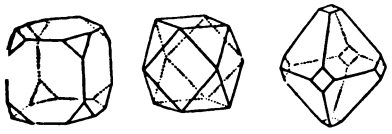
Alunite, (alum stone),
Antimony,
Apatite, (phosphate of lime),
Arsenic,
Biotite, (mica),
Bismuth,
Calamine, (carbonate of zinc),

Calcite, (carbonate of lime),
Chalybite, (carboniferous oxide of iron),
Cinnabar, (sulphide of mercury),
Corundum,
Diallogite, (carbonate of magnesia),
Dolomite, (bitter spar),
Emerald,
Graphite,
Ice,
Kupfer-nickel, (copper nickel),
Magnesite, (carbonate of magnesia),
Millerite, (native nickel),
Molybdenite, (sulphide of molybdenum),
Nitratine, (nitrate of soda),
Pyrrhotine, (magnetic iron pyrites),
Quartz,
Tamarite, (arseniate of copper),
Tellurium,
Tourmaline.

It is difficult to understand sometimes, how certain apparently complex of crystals can be so analyzed as to make it possible to bring them one of the six preceding classifications. The names given to the principorms of each class, as they have been named, pertain to *holohedral* forms, or where the sides are whole, or, as better expressed, where in the complete all the planes have a reference to the axes, and the growth of the crystal therefore be regular. If, however, each alternate plane undergoes excessive very strange modifications of the typical crystaline form of the class to it belongs may occur. These forms of crystals are termed *hemihedral* or

Frequently the addition of new particles to any crystal do not apparently to any established law. This is in no wise the case. By the unequal ion of the molecules new forms may arise, but in all cases they will be as conforming to established law. The passage of the cube to the octais illustrated in the following figures, will explain the fact. The law governs this change is called the *law of decrements*. To explain further:

FIG. 7.



Passage of cube to octahedron.

Suppose that each crystal is made up of molecules so small that if a row or more of them be removed the fact cannot be noticed as to the breaking of the edges of the crystal.. Suppose that, for some reason, an omission is made in accumulation of the particles at the solid angles of the cube, while the of the crystal grows as usual. We will find, in such case, planes will formed called *secondary planes*. If the crystal continues to grow, the cube eventually present the form of the octahedron. This figure is therefore

formed by regular decrements upon the solid angles. Supposing that instead of upon the angles, decrements take place upon the edges, we will then have resulting the figure of the rhombic dodecahedron, as in No. 3 of the first figure

Modification of form may also be so great that with difficulty crystals of common substance are recognized. The three following forms frequently occur in alum:

FIG. 8.

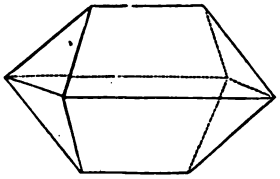


FIG. 9.

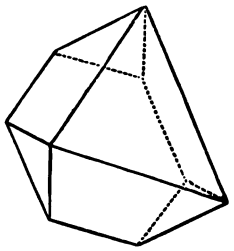
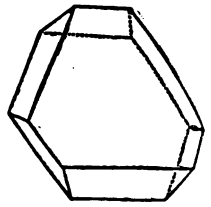


FIG. 10.



It will be observed, however, that whenever two faces form an angle, that angle is always the same in degree, as is found in the regular octahedron.

Many examples of this modification of form are found in the pyramidal system. Thus we have the *double eight-faced pyramid*, with the alternate four-faced solid angles of its base replaced by two faces (Fig. 11 and 12). Or we

FIG. 11.

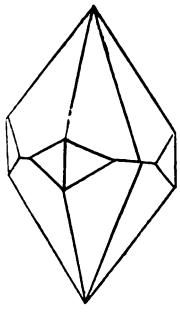
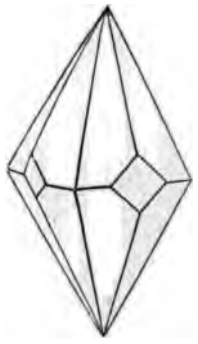


FIG. 12.



may have the *double four-faced pyramid*, with the edges at its base replaced by planes (Fig. 13). Or we may have the *double four-faced pyramid*, with the four-faced angles at its base replaced by faces (Fig. 14).

FIG. 13.

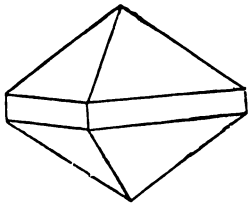
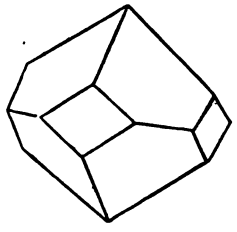


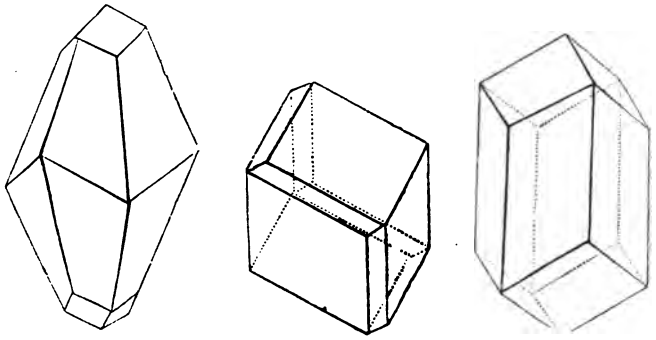
FIG. 14.



As has been mentioned before, several forms may combine and the result will be a crystal of different shape; thus, Fig. 15 represents the combination of

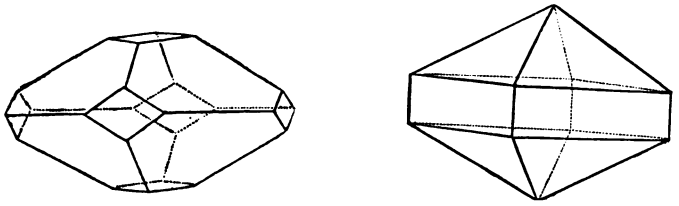
hexagonal prism with the *double six-faced pyramid.* Fig. 16 represents a com- of *scalenohedron* and *rhomboid*, and Fig. 17 a combination of the *rhom-* with the *hexagonal prism.* Fig. 18 is another form of this same combination.

FIG. 15. FIG. 16. FIG. 17. FIG. 18.



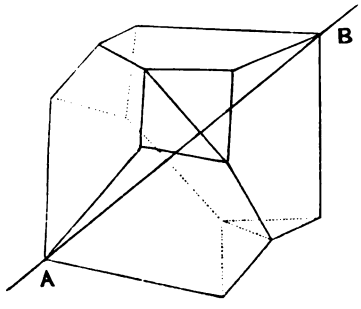
19 represents a combination of a double *four-faced Rhombic pyramid* faces of a *rectangular prism.* Fig. 20 is a combination of a double *Rhombic pyramid* with the faces of the *right rhombic prism.*

FIG. 19. FIG. 20.



remains one form of crystallization to be recorded; that is, the system crystals, or macles. The following definition is taken from the "Circle Sciences": "*A twin crystal, or macle crystal*, is composed of two crystals, portions of two crystals joined together in such a manner that one come into the position of the other by revolving through two right angles an axis which is perpendicular to a plane, that either is, or may be, a face crystal." Take, for example, a cube, bisect its edges and make a section represented by the lines in Fig. 21. Cause the lower section to revolve an angle equal to 180 degrees around the imaginary axis A B, passing

FIG. 21. FIG. 22.



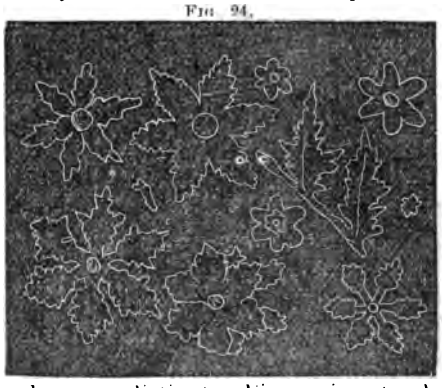
through the center of the cube at C. We will then find the resulting form as represented in Fig. 22, which is the appearance of a twin crystal of the cube.

Many examples of a macle crystal might be given, but the most are those which occur in nature in the form of the snow flake. As represented in figure 23, the stars of snow are formed by three crystals crossing each other

FIG. 23.

thus forming six rays. It would be difficult to recognize any particular form of crystal in a solid piece of ice, yet experimenters have succeeded in demonstrating the beautiful twin crystals of which it is composed, by slowly melting, so

FIG. 24.



that the crystals may become distinct. Fig. 24 is intended to represent these formations, the beautiful ice flowers. The frost upon the window panes follows the same laws and silently shoots its rays in all directions, thus covering the glass with a net-work more beautiful than the finest lace. Prof. Cooke, in speaking of these wonderful formations, says: "The process of crystallization, which is here so beautifully exhibited, is one of the most striking phenomena in the whole range of experimental science. It is, of course, not so wonderful as the development of a plant or an animal from its germ, but then organic growth is slow and gradual, while here beautiful, symmetrical forms shape themselves in an instant out of this liquid mass, revealing to us an architectural power in what we call lifeless matter, whose existence and controlling influence but few of us have probably realized."

There is a peculiar property belonging to some substances whereby the are enabled to present the form of a mineral different from those of which the are composed. These substances are called "Pseudomorphous." "They ma be produced by the decomposition of the crystal after it has been formed, or b another substance being deposited upon it, so as to assume its form. Some times, after another substance has been deposited on a crystal, the crystal ma have been removed, and a third mineral deposited in its cast."*

In drawing this article to a close we cannot but regret that it has been im ssible to go more fully into the minute detail of our subject. If, however, w ve succeeded in so interesting any one that there is left a desire to know mor the laws of nature, we shall be amply repaid for the time and labor bestowe on its preparation. We have endeavored to give the principal facts connecte th the subject, and have left the detail to be investigated by the one wh sires to know still more of the wonderful changes taking place continually i e inanimate world.

TOLEDO, Nov. 10th, 1875.

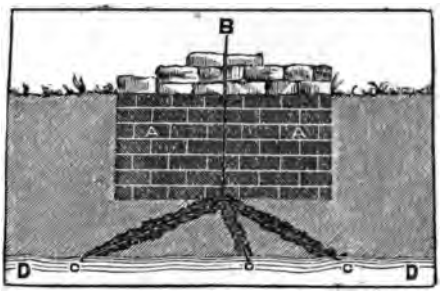
LIGHTNING RODS.

BY JOHN FITCH, JR.

Electricity was known to the ancients, though not well understood. I bout 1650 Otto de Guericke, burgomaster of Magdelburg, discovered som gns of electric light, and De Wall, about the same epoch, saw sparks and hear noise by using friction on a cylinder of amber. Strange as it may seem, the oth compared this to lightning and thunder. Yet when we consider th iarked resemblance of the two, it is not so much of a wonder. Many experi ients were made in Europe to discover the nature of lightning, but it was le or an American to first unravel this secret. Franklin identified lightning a lectricity in the following manner: During a storm he flew a kite made o ilk. As the string by which it was held became wet, the fibres were agitated learly showing the presence of electricity. Soon sparks were obtained b ouching the string. Others tried this same experiment, and by using a wir long the string a large amount of electricity was obtained. By this and othe xperiments the identity of lightning and electricity is established. The natura uestion now is, what is electricity? This is not well understood. Severa heories have been advanced, but it is not necessary to discuss them here. W iave only to deal with the effects of lightning. Lightning travels much mor apidly than even light, which moves at the enormous rate of 185,000 miles pe second. Its movement may be said to be almost instantaneous. It manifest itself in two ways, called positive and negative electricity. Electricity of th

* Circle of the Sciences.

same kind repels, and of an opposite kind attracts. Thus two bodies charged with positive electricity repel each other, but the contrary is the fact if one be positive and the other negative. An equality of each kind of electricity in any body is called neutral. Neutral electricity is supposed to exist in inexhaustible quantities throughout all bodies. Friction and many other influences decompose neutral electricity into positive or negative. The earth and atmosphere are vast reservoirs of electricity. The first generally negative, and the latter positive. Clouds are generally positive from the atmosphere, but frequently negative from contact with the earth. A positive cloud over the earth draws negative electricity, and accumulates it in the earth under it. Then it is that a discharge is apt to take place, either by the electricity from the cloud darting to the earth, or *vice versa*. Then we say the lightning has "struck." It is often the cause of great loss of life and property. To prevent these injurious effects the lightning rod has been invented. It is on the well-established principle that of two conductors electricity always takes the best—that is, the one over which it can flow with the least resistance. Nail a strip of iron to a wall, and the electricity will follow it without injury to the wall. Take away the iron, and the wall, not being a good conductor, is apt to be damaged. If electricity has a sufficient conducting passage, it is disarmed of all destructive energy. The lightning rod is made to supply this passage. It consists of three parts: the rod, or part overtopping the building, the conductor, or part connecting the upper part with the ground, and the part in the ground. The rod is generally of a pyramidal or conical form (the latter being preferable), from eight to thirty feet in height. Gay-Lussac proposes a rod of iron, surmounted by a short sharp cone of brass, ending in a fine platinum needle. The whole must be firmly united. The difficulty of constructing such a rod has led to the use of iron or copper, with a point that will not oxidize. Iron is apt to rust unless painted, but a paint largely composed of lampblack (which is a good conductor) may be used. Galvanized iron is, perhaps, as good as any material. Copper is apt to become brittle when a current of electricity is passed through it. Sharp turns should be avoided. Care should be taken not to allow the rod to come in contact with any metal, but otherwise it should be fastened directly to the building. Glass insulators are useless, and when wet with rain become conductors. According to the Paris commission of 1823, the minimum section of an iron conductor should be as a square of fifteen millimetres (about three-fourths of an inch). This was thought sufficient in all cases. A copper rod need only be about two-fifths of this, as copper conducts about six times as rapidly as iron. How great a space a rod will protect is not well settled. It is generally supposed to protect a space in a radius of twice its height. The highest points and the center of a building should have rods to ensure protection. It is well to connect all the rods together, and have two or more stems in the ground. They should be carried far enough under surface to reach moisture, and it is best to have several points branching out in different directions from the house surrounded by charcoal, which is a good conductor, as in the following figure:



represent the wall under ground; B the rod; C C C its branches
by charcoal and extending to the water D. If the points can ter-
well it is good, as the soil all around is wet and connected with the
well, and consequently carries off the electricity. A cistern will
water has no connection with the earth. The next point to be
s the form of the rod. Shall it be a flat strip of metal, a solid
hollow tube? The old theory was that lightning traveled only on
of the conductor. Prof. Phin, in an article in the *Popular Science*
August, 1875, very clearly shows that this is not the case. *Static*
confines itself to the surface, but it is not so with *dynamic*.
through every particle of the metal. This may be shown in a
One example will suffice: Take a solid bar and pass a cur-
electricity through it. Flatten it until it has a much larger
pass a similar current through it. In both cases its power will be
the same, although in the latter its surface is very much greater than
Hence the efficiency of a rod is in direct proportion to its weight
matter what its form may be. A solid square is the most effective,
most weight in a given length. Many have disputed the advan-
ed by lightning rods, but there is no doubt of their usefulness.
cases they have not proved effective in saving property, it can gen-
to some defect in the manner of construction, or that too large
been assigned to the protection of one rod. It is very difficult to
much protection a rod has furnished, just how many times our
been saved. The rod works silently and assiduously, doing its best
equilibrium which will prevent a discharge injurious to what is
its protecting wing. The watchful care and untiring work of this
may be shown by a simple experiment: When stormy clouds are
break the continuity of the rod the eighth or tenth part of an inch.
stream of electrical light will be visible in the interval between the
parts of the rod; thus showing how it is trying to rob the cloud of its
power. If this distance is increased to an inch, sparks will be
to pass in a rapid and continuous succession, accompanied by detona-
as the report of a pistol. The rod does not draw lightning to a
attempts to carry away what is already dangerously near.

THE AMERICAN SILK WORM.

(*Telea Polyphemus.*)

Order, LEPIDOPTERA; Family, BOMBYCIDÆ.

This magnificent insect belongs to the same family as the well Chinese Silk Worm, *Bombyx mori*. It has received the especial name of

FIG. 28.

FIG. 29.

Colors—Dull ochre yellow—purplish

ıerican Silk Worm, because for all practical purposes it is the only American
ɛ-spinner now known that can be rendered of any commercial value. For
ny years *Sericiculture* or the art of raising silk-producing insects, has been
y seriously threatened with great loss, if not entire destruction, by the
epidemic diseases that affect the Mulberry silk worm. Much attention
herefore been paid lately towards acclimatizing in Europe and elsewhere,
ilk-producing Bombyces in order to supersede, if necessary, the mulberry
Telea Polyphemus being found easy of propagation, its whole history
known and we, therefore, purpose to give our readers a detailed account
transformations, the more especially as it is a tolerably common
rom its size and splendid appearance, both as larva and moth, it is
ıttention and excite the curiosity of those who see it. Hitherto
supposed to feed only on oak, and those who have bred it in large
the silk market have raised it exclusively on oak leaves, but it,
ıttacks the maples and from the enormous size of the
ıts voracious appetite, a great deal of damage is often done.
ıdmirable illustrations of the perfect moth, male and female.
nus describes its appearance: "Its wings are cut off almost square
corners. It is of a dull ochre-yellow color more or less clouded with
n the middle of the wings, on each of which there is a transparent eye-
ɪivided transversely by a slender line, and encircled by yellow and
:ıngs; before and adjoining to the eye spot of the hind wings is a large
ɜhading into black; near the hinder margin of the wings is a dusky
ɛdged with reddish white behind; on the front margin of the fore wings is
ɜtripe which also crosses the fore part of the thorax, and near the base
ɜame wings are two short red lines edged with white." On the under
ɔolors are paler, but the bands are more distinct. The antennæ are
n the male, and deeply pectinated. The wings expand from
nches. When at rest the wings are held elevated above the body
ɔf a butterfly, but if disturbed they are spread out flat, both pairs
The moth usually flies towards dusk or in the early part of
:moths make their first appearance about the month of June.
ays a large number of eggs; she deposits them on the under side of
ɜ single egg in each place.

ɹ. Trouvelot, in an admirable article in the *American Naturalist*, has
ɜ very interesting account of his success in raising large broods of these
ıaving had in 1865, five acres of woodland swarming with insect
ıumbering not less than a million. According to him "the incubation of
ɛgg lasts from ten to twelve days." The caterpillar eats its way out of the
:he shell of which it devours. The larva attains its maturity in about
ɪays, having changed its skin five times during that period. It is about
nches in length, though it has a peculiar fashion of contracting its body,
hunching up its segments, when not in motion. Its color is pale bluish
The segments are covered with orange or reddish warts, or tubercles

which have a pearly lustre, and are furnished at their extremities with hairs. The head and feet are brown, and the tail or anal segment is with a brown V-shaped line. The sides of the body are striped obliquely white.

The cocoon, which is of a regular oval shape and about two inches long formed by fastening together a few leaves with silken threads, in the interio which the larva spins a second strong and very close cocoon in which it into the pupa. These cocoons fall with the leaves in the autumn, and on the ground during the winter until the perfect insect emerges. The pupa very thick and short, and shows very clearly the antennæ and wings. The takes about a week to complete its cocoon. The silk of which the inner one formed is very glossy, rather coarser than that of *Brombyx mori*, and accordin to M. Trouvelot, can be used very extensively in commerce. It has a tinuous thread and can be readily unwound. We are not aware what the length of the silk in each cocoon amounts to, but it must be something great, if one may judge it by comparison with that of the Chinese silk Rennie, in his *Insect Architecture*, in speaking of the latter states, "that length of the unbroken thread in a cocoon varies from six hundred to a thou sand feet; and as it is all spun double by the insect, it will amount to nearl two thousand feet of silk, the whole of which does not weigh above three and a half; five pounds of silk from ten thousand cocoons is above the average." When we see the enormous difference in size between cocoons of *Polyphemus* and *mori*, we can well believe that it may be very advan tageous to the silk grower, to do all he can towards developing the experiment already made in the culture of our American silk worm. We must not forget however, that amongst our ornamental and forest trees the larva is capable o doing much harm, and in the present instance we can only regard it as a noxious insect, and, therefore, one to be destroyed. Like everything else in the insect world, it has its special enemies, being very subject to the attacks of an Ichneu- mon fly, named *Ophion Macrurum*. Hand picking is the only remedy we are aware of.

INTELLIGENCE OF ANIMALS.

In the continuation of the subject of the sagacity of animals we this month give several well-authenticated anecdotes, trusting that by this series of truth- ful facts the good qualities of our friends will become more generally known and their kindly feelings and often almost human intelligence will be more fitly appreciated and that it will induce a more general kindly and loving feeling towards those dumb creatures who are placed under our care and dependent upon us, as our faithful friends and helpers.

A Runaway Horse Stopped by a Dog.—While the gamekeeper at Kilmarnock and his son were returning from a day's shooting at Glinns of Fintry, on Thursday week, on passing the Finnick Toll-bar they both alighted

rom a spring cart, and, after taking a drink at a well, were in the act of paying toll, when the pony took fright and ran off, but had only gone a short dis- when it was observed to turn suddenly on the road and stand still. The and his son were soon beside it, and to their surprise found the dog on its hind legs with a firm hold of the reins in his mouth, and keeping horse at a dead stand, when he civilly gave up the reins to the proper The retriever belongs to Archibald Stewart, Esq., 42 Union street, and "Jack," who is a great favorite with Mr. Stewart's family for his sagacity, has by this act established an additional claim to their esteem. *Mail, September* 21.

A HEROIC DOG.—A gentleman who witnessed the capsizing of a scow at York, some time ago, by it coming in contact with a steamer, gives the account of the occurrence: "After the scow capsized, a Newfound- dog rose beside of it, shook the water from his head and shoulders, and the scene. He seemed to comprehend the situation at a glance, imme- dived under the scow, and a moment afterwards emerged on the other with the insensible form of his mistress held up by his teeth. He sustained a man in a boat took hold of her, when, 'as quick as a flash' the noble dived under the scow again and was gone fully two minutes when he came air and dived again, both times unsuccessfully. He then started to swim boat into which the woman had been taken, and after getting half-way to hesitate, stopped, returned to the wreck and dived once more in a desperate effort to recover the children. This proving unsuccessful, he away and I lost sight of him." My informant says he will never forget noble dog as long as he lives; and I am unwilling that any of the human ce should get any of the glory that belongs to that dog.

AN almost incredible story comes from Bardstown, Ky. It seems that a rtain man, previous to the war, was an extensive slaveowner, and each one of s slaves owned one or more dogs. One of these dogs, a spaniel, manifested mptoms of hydrophobia, and was subsequently shot. Now comes the credible part of the story. Immediately after the shooting, all the dogs on e place collected around the body of their dead companion, and, after a pro- nged howling, prepared for a funeral. The largest and fiercest dog took the dy in his mouth and started for the woods. The other dogs formed into a gular procession, and in single file followed the body to the woods. They lected a tree just outside of a fence, and at the foot of it dug a grave, in which e body was deposited, and the dogs joined in covering with earth the remains, ter which they all united in more howling, which was kept up for some ten or fteen minutes, when they dispersed.

A REMARKABLE BIRD ANECDOTE.—The myriads of sparrows that nestle in ivy which clings to and almost entirely covers the walls of Christ Church, display a surprising amount of intelligence in their little acts of

kindness to each other. From a tree located about opposite to Northrop's Church street, a sick or crippled sparrow recently fell to the ground and fluttered about the sidewalk in vain efforts to regain a place of safety. Several its little companions gathered around it, and seemed greatly concerned for it and by their incessant chirping attracted a swarm of the little winged from the church walls. Efforts were then made by several of the number to the helpless bird by catching its wings in their beaks, but there seemed to be difficulty in getting started together, and the effort was futile, and then chattering increased perceptibly, as if there was a general scolding going on Presently several of the birds flew away, one shortly returning with a about four inches long and an eighth of an inch thick. This was dropped before the sick one, and each end was picked up by a sparrow and held up so that the sick bird was enabled to catch the center of the twig in its beak, and with the aid of the other two it flew over the fence into the churchyard, and from tombstone to tombstone until the church was reached, when they disappeared in the ivy, followed all along by the swarm of their companions, chirping as if in great joy. The whole affair was viewed by several spectators.—*New Brunswick (N. J.) Times.*

THE ROSE BEETLE.

(*Macrodactylus Subspinosus.*)

BY PROF. W. SAUNDERS, LONDON, ONTARIO.

This insect, commonly known as the Rose-bug, which for some years past has been reported as doing damage to grape vines in the United States, has always been present with us; but it has not, heretofore, as far as we know, been much complained of by grape growers in any part of Ontario. In the latter part of May, 1872, we recived a note from Mr. John Ferguson, of Union, near Port Stanley, Ont., accompanied by a box of these insects, asking for information as to what he should do to get rid of them, as they were destroying his grape vines. In a subsequent note he says, "they eat the leaves especially of the Clinton. I found a few on my Concords, but the number was small in comparison to those found on the Clinton; they seem to prefer it, and if left alone, they soon eat all the outer tissue of the leaf, and leave nothing but the net-work."

The fact of this insect showing a preference for the Clinton vine has been remarked before by the late Mr. Benj. D. Walsh, State Entomologist of Illinois, who suggested the taking advantage of this preference on the part of the insect, as a means of lessening the labor attending their destruction. In his first annual report on the "Noxious Insects of Illinois," page 24, he says: "In particular seasons, as is well known, and in particular localities this insect occurs in prodigious swarms, and gather upon grape vines so as to strip them almost entirely of their leaves. The only known remedy that is practically available, is to jar them off the vines and kill them; and of course if we can induce them

:oncentrate their forces upon one particular vine, and let the rest alone, the of destroying them will be very greatly diminished."

Luckily for the grape grower this can be done. There is concurrent from a great number of different sources, that the Rose-bug prefers the to all other cultivated varieties, and will gather upon that and leave the unmolested.

In the *Canada Farmer* for 1867, page 327, the Rose Beetle is referred to as injurious to the vine, as well as many other shrubs and trees, and .s made of its great abundance every year in one locality at Oakville; spoken of in Harris' "Insects Injurious to Vegetation" as hurtful to

ıs called the Rose-bug on account of its appearing annually at the time blossoming of the rose, and of its having been first noticed as injurious lower. The body of this beetle measures a little more than one-third nch in length; it is slender in form and tapers a little towards each Its color is dull yellowish when fresh, arising from its being covered a greyish yellow down or bloom; and its long sprawling legs are of a dull reddish hue, with the joints of the feet tipped with black; the feet are ırmed with very long claws. The down on its body is easily rubbed off, :his is done there is quite a change in the appearance of the insect, :horax, and the under side of the body becoming of a shining black. ollowing excellent account of its history is given by Dr. Harris:

'The unexpected arrival of these insects in swarms, at their first coming, heir sudden disappearance at the close of their career, are remarkable in their history. They come forth from the ground during the second in June, or about the time of the blossoming of the damask rose, and rom thirty to forty days. At the end of this period the males become all to the ground and perish, while the females enter the earth, lay :ggs, return to the surface, and after lingering a few days die also.

The eggs laid by each female are about thirty in number, and are deposited one to four inches beneath the surface of the soil; they are nearly globular, and about one-thirtieth of an inch in diameter, and are hatched twenty ıtter they are laid. The young larva begin to feed on such tender roots within their reach; and when not eating they lie upon the side, with the curved so that the head and tail are nearly in contact; they move with on a level surface, and are continually falling over on one side or the They attain their full size in the autumn, being then nearly three- of an inch long, and about an eighth of an inch in diameter. They of a yellowish white color, with a tinge of blue towards the hinder extremity, 's thick and obtuse, and rounded; a few short hairs are scattered on the of the body; there are six short legs, namely, a pair to each of the first ings behind the head, and the latter is covered with a horny shell of a ust color. In October they descend below the reach of frost, and pass the n a torpid state. In the spring they approach towards the surface and

each one forms for itself a little cell of an oval shape by turning round a great many times, so as to compress the earth and render the inside of the cavity hard and smooth. Within this cell the grub is transformed to a pupa during the month of May by casting off its skin, which is pushed forward in folds from the head to the tail. The pupa has somewhat the form of the perfect beetle; but it is of a yellowish white color, and its short stump-like wings, its antennæ and its legs are folded upon the breast: and its whole body is inclosed in a thin film that wraps each part separately. During the month of June this filmy skin is rent, the included beetle withdraws its body and its limbs, bursts open its earthen cell, and digs its way to the surface of the ground. Thus the various changes, from the egg to the full development of the perfect beetle, are completed within the space of one year."

Although these insects have many natural foes, such as carniverous ground beetles, dragon flies, toads, insectivorous birds, domestic fowls, etc., yet they often need the intervening hand of man to keep them within due bounds. The best means of disposing of them is to jar them from the vines on which they are resting with a sudden and violent jar, to sheets spread below to receive them. They are naturally sluggish, and do not fly readily, and are fond of congregating in masses on the foliage they are assuming; and hence, in the morning, before the day becomes warm, they can be easily shaken from their resting places, and disposed of, either by burning them, or by throwing them into scalding water.—*Ontario Report Agriculture.*

A NEW PEAK.

The following account of the discovery of Handie's Peak is a graphic sketch of the hard work done by true scientists when in the field. Our naturalists are not mere pleasure seekers, but earnest, sober workers.

During the summer of 1874, a party of three United States explorers traversed that southwestern portion of Colorado territory, which may be known to many as the San Juan region. While the general impression was that they would find a moderately high country, with but few mountains of importance, it soon became apparent that this idea certainly was not borne out by facts. It was derived from unreliable sources, and partly from the circumstances that unusually dark and dense clouds spreading over the district in question, obscured any view from a distance. Rugged mountains, separated from each other by equally rugged and precipitous canons were met with, from the very first. The inclemency of the weather by no means added to the comfort of the travelers, and they were obliged to contend not only with those obstacles that nature's bold hand placed in their way, but also with that dreaded enemy in camp, rheumatism. Thanks to the violent exercise the scientific portion of the small party indulged in, they were scarcely affected by the daily drenching that

nflicted upon them, and thus preserved health and good spirits, while the ess exposed perhaps, sharply felt the severe effects of such a life. In when the relatives and friends of those engaged in the pursuit of adding ne store of geographical and geological knowledge of our continent were dered uncomfortable by the summer's heat, scarcely a day passed, during ich they could dispense with their heavy overcoats. Cool as the days might the nights were cooler, and rolled up in heavy California blankets, the pleas- s of out-door life could be fully realized. Returning from a hard day's rk, late in the evening, the meal termed "dinner" was effectually disposed of, umber of logs served to keep up a cheerful fire, and while smoking a cigar- e, the geologist or topographer took time to plan his trip for the day follow- g. Then and there it is, provided no falling of rain or snow disturbs the animity of spirits, that the good humor of these men is revived, and early on e new day they start, supplied with fresh energy, and the firmer intention to rry out their work in spite of all difficulties. In my note-book for 1874, I d the following memorandum: "Aug. 15. Rode 12 miles; station 14; camp ; steep ride down hill; snow, rain, hail, electricity. Disgusted with that sort thing." Such were the impressions after the day's work. A number of days evious to the quoted entry, we had singled out a prominent peak among a oup of heavy mountains, as one of our future stations. From every point cupied during that time, the chances of making an ascent were carefully eighed, and a certain direction decided upon. On Aug. 14th, a "saddle" ear the station of the following day was reached, after a climb of 2,700 feet, d from there the best and the deciding view was obtained. Although the imbing of a peak, that reached an elevation of more than 14,000 feet, belonged y no means to the extraordinary events of the season, it was customary, in a se of that kind, to prepare for an early start, in order to be in camp again efore darkness set in. Early on the 15th, therefore, two tents were pulled up he mules saddled, and after a hearty, but cool breakfast, our party of three tarted out. A ride of about four miles, through a pleasant little valley along he upper portion of Lake Fork creek, brought us to the mouth of a canon that ed up to the base of the station in prospect. Dense fir timber retarded our rogress somewhat, and more than once the mule caught itself, or more cor- ectly speaking, its rider between two trees standing close together. A mild dmonition to the animal, merely to convince it of the authority of its rider nd a graceful retreat was beaten, only to find oneself in precisely the same osition a few minutes later. At last a ray of light penetrated the dark forest nd a clearing appeared. Sad deception! That clearing was a swamp. Owing orographical character of the locality, however, it became necessary to that swamp, and it was crossed. On either side vertical walls of rock he narrow passage and entered a decided veto against any circum Willow-brush, eight or ten feet high, wet with the heavy dew of the night, gently but moistly extended its greeting to the intruder. Worse n the willows, however, was the treacherous soil underfoot. More than once

the astonished mule found itself two or three feet deep in the mire, and onl after several futile attempts succeeded in regaining *terra firma*.

For a short distance further on we passed through a beautiful timber with firm ground to ride over, and the trees a comfortable distance apar Immediately upon leaving it, a singularly beautiful amphitheater spreac the eyes of the rider, who had now arrived almost at timber line (11,60c above sea-level.) From the summit of the prospective station 14, the sloped down steeply to the northeast, nearly forming a precipice. A littl ther down, the sterrile rocks were covered with soil and fresh green gras off to advantage by isolated patches of snow and small, deep blue lake Above this zone of life and quiet beauty, rose on all sides in forbidding the dark purple volcanic rocks, that constituted the mountain we proposed t ascend. Near its top a seemingly narrow band of white rock, although i reality 200 feet thick, stretched across horizontally and relieved the monotor of the sombre colors. To the north extended a long, narrow ridge, broken b many small precipices.

After a tedious zig-zag ride, that brought us nearer to our destination, bot in a horizontal and vertical line, a point was finally reached above which noth ing but the rocky fragments of decomposing strata occurred. It was to take the riding animals any further, and a halt was made, the saddles off, and each mule secured to a huge boulder. Slowly a hazy mist began t approach, and we knew that no delay was advisable. Starting from tha 2,000 feet below the summit, armed with instruments, and I with my rifle, w began the ascent. Before long, however, it appeared useless to carry seve a half pounds of iron and wood in addition to the necessary baggage, a mountain sheep I had counted upon, would not appear. My rifle was, there fore, placed under some projecting rocks, sheltered from the probable rain, anc the ascent continued. More than once it became necessary to employ al four extremities, to pass over places that were nearly perpendicular. The climl was not what might be called a difficult one, because there was no direct danger of being confronted with eternity by a single false step, as in many other instances. One little "saddle" after the other was passed and the summi reached after two hours' hard climbing. Small fragments of rock, weathering in thin slabs, greatly impeded our progress, and increased the fatigue of the climb. To use a characteristic expression, it was necessary to pull the moun- tain down to you in order to reach the top. Every step forward was followed by a corresponding backward movement of more or less uncertainty, so far as its extent was concerned. Guided by the trails that had been trodden by mountain sheep, we were spared the trouble of selecting the best route, and true to their instinctive knowledge, these animals had certainly selected the places that afforded the surest footing. We soon reached the highest point, 14,050 feet above sea-level.

It was evident, from a hasty observation, that no time dare be lost, as a storm was approaching that would most likely be accompanied by a display of

phenomena, besides a dense fog; consequently the grand mountain that otherwise must have been a portion of our reward, was partially lost. n close proximity showed to their best advantage, in the half subdued standing in bold relief against the stormy sky. Particularly one group, were accustomed to designate as "Old Red," presented a picture that n its effect. Bright colors, changing from Orange to red, brown, passing into darker shades again, characterized that nobly moulded Several intensely colored lakes, green and blue, were within a short dis- f present to neautralize the dark colors the rocks show. Off to the very far distant, a herd of nine mountain sheep was leisurely feeding scant supply of grass. Strange as it may seem, no one was found descend the requisite distance to procure a rifle, and even my sports- became cooler at the thought of a second ascent. For a long time watch them, and although, as usual, they had a guard placed to lee- seemed to take no notice of us, and slowly traveled down hill, feed- way. As always, the regular work was soon commenced; the and topographical notes completed as soon as possible in view of the storm. Barely had the work been carried on so far, that it might be finished, before it really set in, beginning with snow, then hail, and ing electric phenomena. Hastily snatching up the instruments a beaten, more rapidly perhaps than the ascent had been made, and beneath the first ledge on our downward course. Even there the was very strong, and a few moments later the point just abandoned by lightning. As the wind had gradually subsided, there was no the clouds dispersing, and we commenced the descent. Save the fact were thoroughly drenched, for the snow turned into rain lower down, occurred worthy of mention. We found our mules where we had looking melancholy and very wet. Silently the ride campward was almost as silently finished. A pouring rain was our faithful companion he whole time. We rode down the steep hillsides in a zig-zag line, either he one foot in the wet grass, or lifting it high out of the stirrup. Of steep rides during the season this was certainly the steepest, and con- that, for more than one thousand feet vertical distance there was but this unbroken glassy slope, a false step of the mule might have an elaborate downfall of man and beast. Finally we reached the obliterated trail that the pack train had made early in the morning, and t to camp. Here a blazing fire had been made by our "boys," and attempted to dry our buckskins. After dinner, which was late that ncidents of the day's work were duly related and discussed. I named the most prominent and easily recognizable mountain of that group, contains the headwaters of Lake Fork) Handie's Peak.—*American*

THE AMERICAN ELK.

Of all the deer tribe, none appear to better physical advantage that the subject of this sketch when it is surprised by the hunter, on the slopes or valleys of the northwest. Of imposing size, of most shapely and proportion, and of free, graceful action, with a short whistle and flas its big, brown eye, how nobly it moves off, disappearing as though it wer pleasant excitement of the brain, in the dense copses or jungles of it haunts! No one, we will venture to say, has ever stumbled upon a herd o as they may have been feeding on some little grassy opening, without feelin heart leap to his mouth with exhilaration, for the sight of the handsome just before they gather themselves up for the final plunge out of his sigh be one that will indelibly stamp itself on his mind, and days afterward, a may travel or scout along, it will recur to him again and again with satisfaction. We do not write in this strain altogether as hunters alone such exclusively we are not, and as such we did not see alone, but as who were pushing across the great divide of the Continent between the wate of the Missouri and those of the Snake or Columbia, and while traversing wild country, we were constantly emerging from dense pine forests into little grassy savanas, in which were occasional lakes fringed with reeds gravelly beaches, where herd after herd of the "wapiti" were surprised were peacefully feeding on the soft shade ripened grass, or cooling thei brown and gray flanks in the clear waters, causing those elaborate picture deer parks in the old world, to rise often in memory. Scenes, enchantin these, far away up here in the solitudes of the Rocky Mountains, migh served as studies for those grand old artists of earlier times who have especially in depicting the forms and surroundings of these animals and kind, so perfect is the finish and refinement of these little characteristic meadows, with here and there a careless, pretty cluster of firs and standing out by themselves above the rich, rank growth of grass and annuals at their feet, while a dense forest invariably walls in all sides of thes wee prairies, into which the deer vanish with the rapidity of thought alarmed.

Yet, charming as is the natural landscape of the elk's habitat here, stil must be borne in mind that these beautiful spots in this wilderness, when sun has its only chance to reach and warm the cold soil, have a grea thorns for the deer. Swarms of mosquitos, myriads of small, black, gnats, and huge, buzzing gad-flies swoop down during the summer upon unhappy creatures, and torment them night and day; so much so that no how high or rugged the accessible mountain tops and ridges may be, the trail o the elk will be found all over them, where it has traveled so as to get up into the wind which will, if fresh, drive their enemies away from them, and bur plagues, for the time being, in the grass and moss under foot. There are in Oregon, large swampy lakes, where these animals will congregate in numbers more or less, and spend the heat of the day immersed in the water, fo

n until they cover all but their heads and necks, which they ever and anon
nder, the slapping of their handsome antlers making a noise that will
heir position to a keen ear a long way off through the woods and thickets
nviron them.

The morbid watchfulness and sensitive apprehension of danger shown by
when alone with her fawn or fawns, is really touching; the furtive
every mouthful taken stealthily, with backward, forward, and all-
glances of the eye, accompanied by a corresponding sympathetic move-
he nervous ears, comes out in strong contrast indeed, with the indiffer-
attitudes of the progeny. But let the mother sound an alarm, and
ellows are at once nerved up, and bound off like streaks of light in
wake of the old one. When, however, the elk herd together along
August and September, they lead a much less restless life—have in their
and consequent confidence, much less apprehension, and speedily grow

nd Gun.

CAPT. THOMAS HUTCHINS.

SCIENTIFIC MONTHLY:

a note appended to the able address of Prof. Comegys, at page 74 of
number, it is said of Gov. Tiffin, "that he organized the system
nd sales (of the public lands) that has continued to this day." By
—no doubt inadvertently—manifest injustice is done to the pre-
of Dr. Tiffin, in the office of the Surveyor-General.

hese, Capt. Thomas Hutchins, of the 60th Regiment of foot, should be
as the originator of the system—the others as improvers. This
soldier first presented the plan of rectangular surveys in sections of
square, the sides to be north and south and east and west, in the year
han ten years before the Revolution. Before this time, our system
which is the simplest one yet known, had never been practiced by
so far as I know. Hutchins was born in New Jersey, prior to
entered the British army before he was of age; was promoted to be
nd Engineer to Col. Bouquet's expedition against the Western Indians
and remained in service until the rebellion in 1775. A large part of
in Smith's account of Bouquet's expedition to the Ohio and the
in 1763-4, was furnished by him, which was published at London
His plan of surveys and settlement in Ohio, form part of the work on
expeditions. From this and other writings of Hutchins, he appears to
een a man of high mathematical talent.

he Revolution occurred, he avowed himself in favor of the American
and not only lost his commission, but was imprisoned in London and
onfiscated. Escaping to the United States, he was made Geo-
o the Confederacy.

this capacity he acted with the army as topographer and map-maker
the war. When, in 1784, the government determined to survey and sell

the public lands northwest of the Ohio river, the whole business was to him. Here he had, for the first time, an opportunity to put his plan of in practical operation. His office was fixed at Pittsburg, and the surveys menced on the Ohio at the west line of Pennsylvania in 1785.

He superintended, in the field, the running of the lines of the first ' Ranges," during that year, under a military escort, on account of hostile These Towns and Ranges lie in the counties of Columbiana and Jefferson, and were the first government lands sold. In 1789 Hutchins died, and buried at Pittsburg. From this time to 1793, the Secretary of the Treasur charge of the public lands, but the Indian wars prevented extensive or sales.

General Rufus Putnam, of Marietta, Ohio, who had been a military in the Revolutionary army, from Massachusetts, was the first of the United States. What work had been hitherto done, was upon the of Hutchins, which, with improvements in regard to accuracy, has been tinued to this day. Col. Jared Mansfield, Professor of Mathematics at Point, succeeded General Putnam.

During all this time the surveys of the public lands had been entruste men of high mathematical attainments, who were required to oversee the of their deputies in the field, in person. Governor Tiffin was appointed ir to succeed Col. Mansfield. His profession was that of a physician, in and as a legislator, he acquired a well-deserved reputation.

He performed the duties of Surveyor-General satisfactorily, but not as expert in mathematics. It is not probable that his predecessors, Putnam and Mansfield, had so far failed in that position that any one then introduce a new, or greatly improved system of surveys. Hutchins invented the United States plan, before Gov. Tiffin was born. It is a to revive the long-lost memory of a man so meritorious and patriotic. He serves a monument and a general public recognition. I have spent seasons in explorations beyond the settlements, where the lines run through forest by our hardy surveyors were our only guide. Every section showed me precisely the position and the distance from all parts of the lands of the United States.

I have often in the northern wilds blessed the genius of Hutchins, fo invention so simple that every one can understand it, and so accurate tha mistakes of position can occur.

The surveys of all other countries are complicated and difficult tc hend. Verbose descriptions are necessary to locate the premises. Unde system, a few figures or words, giving the quarter-section, Town, and makes it unmistakably clear, all of which is cut in abbreviated character numbers on four trees at each section corner. Ohio was the ground for the system, but when it came under the supervision of Gov it had been extended to Indiana and Illinois.

CHARLES WHITTLESEY

CLEVELAND, O., Nov. 2d, 1875.

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TOLEDO

The Scientific Mon

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OPINIONS OF THE PRESS.

We should have noticed earlier the reception of a new monthly devoted to the interest of Natural Science, published in our city, under the editorial management of Mr. E. H Fitch, who is also its proprietor. The pages of this magazine are crowded with interes ing material, furnished by home and foreign contributors, which give promise of development of a valuable work in our midst.—*Toledo Commercial.*

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TOLEDO,

VOL. I. 1876 NO. 4.

JANUARY.

THE

A MAGAZINE DEVOTED TO

Natural Sciences.

E. H. FITCH, Editor and Proprietor.

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The Scientific Monthly.

VOL. I. No

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The columns of the SCIENTIFIC MONTHLY will be freely open for all well writte on scientific subjects, and the candid setting forth of opinions and views or Science.

Any papers sent to the editor will be carefully preserved, and returned to th butor if desired.

The Secretaries of Scientific Societies are respectfully solicited to forward to th as soon after the meetings of their respective Associations as convenient, all reports o proceedings and synopsis of essays and addresses read before them.

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WHITE THROATED SWIFT—NATURAL SIZE.
[Drawn from nature by E. H. Fitch.]

he Scientific Monthly.

DEVOTED TO THE NATURAL SCIENCES.

I. JANUARY, 1876. NO. 4.

THE WHITE-THROATED SWIFT.

(*Panyptila Melanoleuca.*)

small, triangular, broader than high; closed wing the length of the bird, tip of bill to end of tail; tail half as long as wing, moderately feathers rather lanceolete, obtusely pointed at the end, the shafts but not projecting; the tarsus and the toes are feathered to the claws, on the under surface; tarsus and toes short and stout; tarsus equal to oe, without its claw; three anterior toes equal; hind toe short, placed side of tarsus, half versatile; bill equal to middle toe; ten feathers in en, second longest, first equal to third, claw on middle toe longer ligit; depth of fork of tail half an inch; wings extend full one inch quarter beyond end of tail. Colors.—This species is brownish black all except the whole throat, breast, middle of belly, as far as the vent, a patch side of the rump, concealed by the closed wings, the outer edge of the blotches on the inner webs of the middle tail feathers at the con- bases, and a band across the ends of the secondaries, which are white. ive inches and a half; wing, five inches and a half; tail, two inches and tarsus, two and one-half-eighth inches; middle, inside and outside toes hind toe, one-eighth inch.

Perhaps no bird possesses greater powers of flight than this little ærial Spending almost its entire existence in the air, and a large portion of it upper regions, at such an immense height as to be far beyond the reach vision, it seems to be truly an inhabitant of the clouds. Passing of its time gliding about in extensive circles, with immovable wings. pleasant weather keeping at great heights, but when cloudy flying They are very sociable among themselves, congregating in flocks, but associate with other birds. Their flight is of almost incredible swiftness. From the great extent of their wings, they seem to be made for an existence air, and may be taken as the type of those ærial birds, the Swifts. So

powerful are their wings, that no amount of exertion seems to tire them. morning till night they remain on the wing. They dart with the rapidity an arrow upon their prey, and indulge in every conceivable variety of while they sweep through the air. They, however, seem comparatively at when upon the ground, and from the shortness of their legs and great lengt their wings, experience some difficulty in arising, so are accustomed alight upon the edges of cliffs, where they can easily launch forth into the They are of a restless disposition, spending but a few hours of the night i repose, and require a great amount of food, which consists of insects, by them while upon the wing. They also bathe and drink while flying, b dipping into the water as they skim over its surface.

They make their nests in crevices and natural openings in the face of th vertical walls of the deepest canons, and high cliffs, and upon the ridges on th sides of precipitious rocks. The eggs are three or four, and pure white. female alone broods over the nest, while the male keeps near to cheer and her. They are a very noisy and pugnacious bird. Sometimes a couple are see to attack and fasten upon each other high in the air, when they will fall, whirlin round and round, clinging to each other until they reach the vicinity of th earth, then separating and flying away.

There is comparatively little known about the habits of this beautiful bir on account of the short time it has been known to naturalists. It was ered by Dr. Kennedy, on Bill Williams Fork, New Mexico, Feb. 16, 1854 owing to the almost incredible rapidity of their flight, and the heighth they in the air, are of all our land birds the most difficult to procure, so although found in great numbers, they are among the rarest of birds in and collections.

Their range of habittude extends through Utah, Colorado, Nevada, Ar zona, Southern California, the southern portion of the Rocky Mountains, int Guatemala. The family of Swifts to which this species belongs, is cosmopol itan. One species inhabiting Japan and China, make the edible birds' nest much prized for food. These are constructed entirely out of the saliva of th birds. All the species have highly developed salivary glands, and use th tions to cement the materials of which their nests are constructed, as instance, our common Chimney Swift. Many curious nests are constructed b different species of Swifts, one, the *Panyptila Sancti-hieronymæ*, which inhabit Gautemala, makes a tube-like nest some feet in length, with the entrance on th under side, the upper end being fastened to the lower side of an overhangin rock. The eggs are laid on a shelf inside, near the top. Another species als construct a long, hollow, tube-like nest, which it attaches to the horizonta branch of a tree, and as there is no shelf for the eggs to rest upon, they ar supposed to be attached by gum to the side of the nest, and brooded upon b the bird in an upright position, as it clings to the sides.

The White-Throated Swift sometimes sweeps up and down along the face o the perpendicular walls of the deep canons, as if examining them for a place t

a nest. Its note is a loud, shrill twitter, often repeated. Everything
:his little bird seems made expressly for a vigorous, active life in the air.
wings are very long, strong and pointed. The outer web of the first pri-
:s very narrow,—only just as wide as the shaft of the feather,—so that it
a firm, stiff and unresisting surface to the air. The tail is short, stiff
rather broad. The head is flat; the legs short; the feet small and also
the body compact and firmly knit together, thus giving great compass of
the least possible amount of accessories to carry while flying; and as
stout legs and feet would be entirely unnecessary and only a burden to a
:ts entire life upon the wing, they are reduced to the least possible
The mouth is very wide, the opening extending back to and beneath the
of the eye, to enable the bird to catch its insect prey. The bill is flat
and the whole plumage close, thick, smooth and firm, presenting a
even surface to the air, not easily ruffled in flying,—all showing how
and admirably are Nature's works, made for the purposes and the
they are created to occupy. If man were to try and create a being to
move its entire life in the air, what more fitting model could he adopt
perfect example before us. And thus, upon examination, we will find
all the material world, from the most minute microscopical being
largest of the animal world. Too frequently are we given to conclude,
some object in nature appears to our limited understanding useless, or
positively hurtful, that it should be destroyed, and is created for no
useful purpose; when upon investigating its habits, its structure and its
as it lives a free, untrammeled, natural life, we will be compelled,
to acknowledge, that it is not only created for some good and
purpose, but that it is admirably fitted by nature to occupy the posi-
:o it,—every member being constructed with the greatest precision
nicest exactitude, as if planned and built by the most perfect of skilled
What seems to a superficial observer as utter confusion or disorder, will
to be the most perfect harmony and regularity if examined by an inquiring
So infinite and so innumerable are the works of Nature; so varied
ersified the modes by which the great plan of creation and that
mystery, life, are carried out, that, in order to only partially under-
:omprehend their signification, the closest study is absolutely necessary.
all who take the pains to enter upon this investigation are richly
For it discloses such nicety and beauty and such varied forms of the
of means to ends, such admirable fitness of every being for the place
of life designed for it; and not only this, but each part of that being
fitted for its sphere of action, and running through all it, develops
end a glorious and magnificent plan, a complete and stupendous yet per-
whole, composed of myriads of complex organizations, worlds within
creations within creations, that the mind of man stands amazed at the
disclosure. When we remember that every tiny blade of grass, even
of water just large enough to hang suspended from the point of a needle,

may abound with teeming inhabitants, that, in their tiny world, live and love and hate, are devouring and being destroyed by their enemies; when we consider that the vast and boundless ocean is filled with its multitudes of living inhabitants, as well as the immense extent of land, with its forests and deserts all populated with their peculiar denizens, each having its own characteristic life; for every living creature, no matter how minute or insignificant, has a history of its own, and each has distinctive qualities by which it may be known from its kindred; each having its own mode of life, its territory, and its peculiar manner of feeding, and duties to perform, and all guided and controlled by the same omnipotent hand. When we reflect further, that this great world, filled as it is with its multitudes of living creatures, is but one of the millions of other globes (some much larger and more splendid than ours), what wonder that we are led to exclaim in awe, with the inspired writer of old, "Lord, what is man that thou art mindful of him?"

This all shows in the Creator a mind of the nicest discrimination and broadest comprehension, carrying out at one and the same time the minutest details with faithful accuracy and wonderful precision, but creating all to serve the purpose of perfecting a grand and comprehensive plan, embracing not only the wonderful details of this globe and its teeming populations, but other worlds and systems, larger, more extensive and grander than ours; protecting the minutest insect crawling unseen and unheeded upon the tiny leaf, and at the same time controlling worlds and systems of worlds revolving for ages upon ages with a regularity and precision far more accurate than the most delicate and perfect of machinery made by human ingenuity.

There is still another thought in connection with this subject of some importance. It is in nature that we find the most perfect models for our adoption of means to carry out the accomplishment of ends. Here we find the most perfect and nicely-constructed tools, ready made and in use for our investigation and adoption as models. Among insects we will find examples of all, or nearly all, the instruments in use—saws, lancets, files, spears, suction-tubes, pumps, pincers, hinge-doors, trap and spring-doors, and other things far too numerous to mention, and all of the most perfect construction, and in harmonious working; and so it is, to a greater or less extent, in all the various classes of the material world, even our most delicate and intricate instruments have their prototypes among the lower animals; for here will be found most perfect and complex, yet complete, telescopes and microscopes. We will find, upon investigation, that there are sailors, with their tiny boats, sails and oars, that float over the bosom of the waters; masons who lay walls, and even make bricks with their appropriate tools; tailors sewing and making their garments; weavers constructing their cloths and using them also; silk manufacturers, carpenters, and engineers laying out tunnels and constructing bridges; we will find, also, some devoted to war, having regular armies and officers, who go to battle in regular array; we will also find others who are entirely occupied in the pursuits of peace and industry, who build houses of many stories, containing regularly-

:ı ;quares ;es.
y upon the land are these structures found, but in the sea are edifices
of the most enduring material, by tiny creatures, scarcely large
to be noticed, who build up islands and reefs so extensive as to be avail-
ıabitation by man.

then, are a few of the vast number of instances of this beautiful and
creation. Who can resist the impulse to study more and investigate yet
and discover greater wonders in this inexhaustible and enticing field?
is open and beckons you on; the pursuit takes one out among lovely
into the open life-invigorating air; amidst flowery fields and silvery
through fragrant forest glades; it teaches lessons of order, wisdom and
gives us knowledge, exercise, health and profitable occupation; it takes
:he turmoil, passions and care of sinful humanity, out among the free,
:reatures of nature. Should any one complain that they are unable
:his delightful study for want of time or means, let them know that a
:an be learned without books and instruments.

SOURCES OF PLEASURE IN LANDSCAPE.

)assion for scenery of some sort seems nowadays almost universal in
:ife. A "point of view" is an object of solicitude for a house, for a
a garden-seat, for the bench of a pot-house, for the belvedere of a
People climb a gate or a mountain, just for the view! They ride
coaches, and crowd the decks of lake steamers, for the same
All sorts and conditions of people seem to share in the desire. If
:hemselves in Cumberland dales, actresses and dancers retire to
ıp Rhine castles and abandoned monasteries, command-

even follow Mr. Ruskin's gorgeous word-painting into all its vagaries, and become learned in "mountain outlines" and "cloud-chariots." What does it all mean?

Whatever it means, it is associated with great varieties of taste and many degrees of appreciation. A navvy smoking his pipe on a well-placed bench, an artisan shot out by a train among woods and rocks, a citizen sipping his glass in his "little bit of an arbor," do not experience the pleasures that belong to even moderate culture. And yet they like it. Taglioni liked to float in her barge on the waters of Como, but could she even understand the emotions which Arnold has described on thrice visiting the "angle of road under chestnut shades," which commands that scene of beauty? Degrees of culture, and varieties of taste, to some extent disperse the crowd, when they take to travel. Some will seek the populous shore, some the lonely beach; some the moor, some the glen; some rocks and snow, some the bevilla'd lake. Each scene of nature finds its votaries, and all the inns are full: the bow-window at the watering place, the bothy door in the highlands, the trellis of the auberge, the balcony of the "grand hotel."

We have called it a passion of modern life, for its development is modern and European. Other races and other ages differed from us, and from each other, in their notions of scenery. The Hebrew looked upon nature with other eyes than the Greek; the Roman could not sympathize with the Norseman; our own immediate ancestors would be amazed at us. By the Greek mind natural scenery is characteristically regarded in connection with man, as reduced to order, fitness, and utility through architectural adornment, horticulture, or the labors of the husbandman, and thus made subservient to his comfort or enjoyment; or, as the immediate background to the human figure, divine or otherwise, and the appropriate stage for its emotions. The poetry of India and Persia deals with nature more in its seductive aspect, as an adjunct to scenes of luxury and love. Hebrew literature, on the other hand, contrasts the littleness and feebleness of man with the beauty and majesty of nature, because connecting these always with the greatness of God. The Roman, again, was still more utilitarian than the Greek. He looked at nature more with the eye of the wealthy land-owner; or as subserving pleasures of the flesh; or as offering a field for the engineer. He laid out roads and great public works. He secluded himself in luxurious villas. If he liked the country, it was that he might be surrounded by a large establishment; that his fruit and his fish might be served in perfection, that he might be fanned by soft airs, and find soft paths for his feet; where too, when so minded, he might resign himself to philosophy, or discourse with a select company of friends upon men and manners. Untamed nature was to him repulsive. It has been remarked that "no description of the eternal snows of the Alps, when tinged in the morning or evening with a rosy hue, of the beauty of the blue glacier ice, or of any part of the grandeur of Swiss scenery, has reached us from the ancients, although statesmen and generals, with men of letters in their train, were constantly passing through

into Gaul." All these travelers think only of complaining of the
of the way. Julius Cæsar upon one such occasion actually beguiled
time by preparing a grammatical treatise!

ntroduced, though slowly, a new order of sentiment. To the
was opened, as to the ancient Hebrew, a view of nature as the express
of God, and as instinct with providential care. The Christian, after a
could be at home anywhere in God's world; and when the necessities of
combined with false views of life to drive him into the wilderness,
helped to keep him there as the contemplative hermit, and
formed a taste for such scenes. In the letter of St. Basil to Gregory
describing his retreat among forests, upon a steep mountain side
we find a style of feeling more akin to the romantic than in any
ment of antiquity. But though the Christian recluse in a measure
his seclusion, it was probably more as a seclusion—a retreat from the
of the pagan social world—than for much else; and perhaps the naked
was never agreeable to him, except as testifying to his total renunciation
was pleasant to the senses. Christianity could not in such a matter
tastes of race.

Northern nations, Scandinavian and Germanic, possessed wholly
sympathies. Among them, for the first time, we find the spirit of man
; the spirit of Nature in her wildest moods: welcoming a contest with
ejoicing in the tumult of the elements. The classic mind confessed
only in sparkling streams, the song of birds, the chirp of the cicada.
e soul was attuned to sympathy with the thunders, whether of sea or
h the roar of the torrent and the howling of the forest. The imagina-
the one was stirred by Nature's soft subservient beauty; that of the
lled at the spectacle of her terribleness.

it was principally as answering to his own fierce and restless passions
Northern loved the wildness of nature; and as civilization in the hand
anity tamed or directed these into new channels, his predilections were
fied that the forest with its dreary dimness afforded sufficient scope
excited fancy. Hence it is the "woodland" that occupies so large a
the tales and poetry of the Middle Ages. And if the passion for sport
to do with this delight in leafy glades, still more we believe it was
an inherited sensibility of the race to mystery and gloom. If the baron
o issue from his towers with hound and horn, he loved also the still
of the scene when the chase was done. If the outlaw was driven to the
for safety, he learned there the secret of its wild charm.

s true that the mediæval man had always some fear of those dark shades,
by he knew not what of elves and sprites; and it is true also that
sometimes took the opposite direction of a pedantic pleasure in the
and trim-cut pleasaunce; but still comparing him with his classic prede-
we cannot but be struck with his heartier relish for Nature as he found
with the greater depth and range of his susceptibilities. His habits

of life aided the tendencies of his original temperament. His castle was perched on its lonely rock for security, or perhaps for purposes little better than those of a brigand, but lifted up there among clouds and mountains, the occupant must needs sometimes deepen his sympathies with all sources of the sublime, and learn to watch the streaming shadows, and the sunset rays, for their beauty, as well as the distant mule-track, or the winding stream, for some luckless traveler. And if the abbey was planted at first in the wooded dell, mainly for seclusion, and for the fish of the brook, those lovely spots must have wrought their spell upon all gentle souls; and we cannot regard the choicely-set edifices commanding the sweetest reaches of the watered glen, without admitting them as evidences of a taste for the picturesque, and as proof that the founders loved to feast the eye, if also the appetite.

Yet the modern taste for landscape is again composed of new elements. To us has been revealed for the first time the poetry of dreariness. It has been reserved for us to feel the power of the untrodden wilderness, the level desert, the endless prairie, the Siberian steppe: of the glacier field, and of Arctic seas. It might seem that to us especially had that invitation been addressed, "Come and see what desolations the Lord hath made in the earth." Our most popular books of travel furnish sufficient justification for this remark. Arctic voyages, Alpine adventures, explorations among the wildest regions of the west, or the scorched deserts of the east, form their staple; while again a large proportion of the summer tourists, who do not leave our own shores, show the same preference, seeking the moorlands of Yorkshire, the solitary lochs of Scotland, or the surf-beaten rocks of Connemara. Doubtless there are many who feel no such emotion: we speak only of that which is distinctive, and most certainly at no previous period has any such appetite displayed itself. It is even of very recent growth, and a few generations back was entirely unknown. Read the accounts of those who accompanied the Duke of Cumberland's army to Culloden, or who were afterwards quartered at Fort William, and you will find the most amusing diatribes upon the "ugliness of the scenery," "the great black hills," the "treeless moors," the "horrid rocks." Yet the great-grandsons of those gentlemen now rejoice to possess a shooting lodge some twenty miles from a road, or to spend their honeymoon on the bleakest shores of Skye.

We have thus noticed a great variety of taste in scenery as belonging not only to different classes among ourselves, but as distinctively marking different periods and nations. The enjoyment of landscape must, therefore, be composed of various elements, and invites analysis. This diversity of taste must be connected with a diversity in the sources of pleasure, and these we purpose now to investigate.

They may be comprised under the following principal heads: THE UTILITARIAN, THE SCIENTIFIC, THE ARTISTIC, HISTORIC, POETIC and MORAL.

The UTILITARIAN is, perhaps, the most common ground of pleasure in landscape. This point of view includes all that conduces to the personal comfort and bodily wants of man. A well-plowed or fruitful field, a high-cultured

rich soil and fertilizing water courses is agreeable. Fat pastures
:he eye (especially of the proprietor), and the political economist must
be delighted with a well-tilled country, studded with commodious farm
and weather-tight cottages. A general air of satisfaction diffuses
the countenances of the passengers in a railway train as it passes
such a district. And a similar gratification is experienced by certain
at witnessing "capabilities" of various kinds,—water power which may
mill, indications of mineral wealth, and conveniences for railroads,
for refuge, or ports for traffic, sites for building speculation, and all the
specialties which appeal to a man's business and bosom. And under
we may include the sporting facilities of a country, for certainly good
open country, and a convenient distribution of hedges, are elements in
of great importance to redcoats and buckskins, and contribute to a
egard. While, again, the angler possesses also his own source of
difficult, perhaps, to place under its most appropriate head. We are
that it has most to do with the poetic element, and that, not because
visionary nature of the contents of the basket, but from the
dreamy passion for natural scenery which often distinguishes
of this branch of sport.

:owns are no dis-sight in the utilitarian point of view. They
with a desired activity. The drifting volumes of smoke indi-
"the pot is boiling," literally and metaphorically; and the distant
:he streets, and the buzz of voices, are welcome tokens of busy life.
reason, nothing is so pleasant to some minds as the perspective of
road, and it is a coveted window which commands it; while, as may
balconies are put out, and the roof of many an ale-house made
just to survey the bustle of a railway station.

are some of the homlier manifestations of the principle, but it is
utilitarian considerations affect the most cultured minds, and this
that moral element which we shall afterwards consider. The spec-
n adaptation of means to an end, of ordered and well-arranged
convenience and appropriateness, is a worthy spectacle. Man is a
and a busy animal. He has all nature put under his hands to con-
to be busy with; and it is inevitable that he should delight in
her subjection, and the endless applications of human ingenuity to
The Greek and Roman tastes were, as we have seen, decidedly

modern continental idea of a desirable landscape partakes very much
sentiment. It must be lively, festal, easy. The universal residence
:own attests this. The promenades, the avenues and gardens, the
and trellises, the numerous seats and tables in the open air, are all

evidences of a social taste which likes Nature chiefly as she can supply soft airs and fountains, green shades and flowers, with perhaps an expanse of blue water for a boat, or a bright river for breezes. A country house, absolutely the country, would to most be intolerably dull.

Amongst ourselves a practical utilitarianism, which is neither of the Roman nor the Grecian type, is very strong. In pursuit of our practical objects care not for the utter defacement of Nature if she stands in our way, and indeed, for the most part, perfectly unconscious that we have defaced her. Perhaps in no civilized nation has disregard of the beautiful in our daily surroundings been carried to such an extent, and surely much to the detriment both of daily happiness and of mental refinement.

Yet we possess a strong taste for natural scenery, and as we have already observed, at certain seasons all who can, rush away from their homes and perambulate Europe for a prospect. But, with certain exceptions, we have little care for the landscape about us. We only think of our towns as places to work in, not to live in, and break out consequently with periodic and frantic eagerness for a holiday. When we return we are a little shocked at first with the bald and dismal aspect of things, but we soon reflect that it looks "business-like," and are comforted.

Utility, however, in some form or other, will always have a large influence in the appreciation of scenery. Its most pleasing phase is habitableness, and this is quite consistent with natural beauty, nay, may be made to enhance it. The charming shores of the Italian lakes are greatly indebted to the towns, villages, and villas which glitter along the wooded heights, and bead the blue waters like a string of pearls; and most continental prospects over plains, or broad valleys, are interesting on this ground. Similar prospects in our own country are too often obscured by clouds of smoke; or, if that is absent, it is only to display the perverse ugliness of every roof and wall and chimney. Still there are stretches of scenery along some of our rich and populous valleys round some of our bays, or comprising distant views of our great towns, which owe much to the evidences they present of wealth, prosperity and comfort.

There is, however, a peculiar kind of scenery coming under this description, in which England is unrivaled: this is the domestic or home landscape, scarcely to be met with, as we understand it, in any other country.

Here, it is the result of our national predilection for home life, country life, and the exercise of individual rights. Under these influences every one wishes to invest his personality in a visible circle of possessions, and to collect round himself (the important central unit) every adjunct of a self-contained family. A man rejoices in his own garden, his own paddock and pond, his own farm or park; and quite regardless of what may be on the other side of his paling or his hedge,—the other man's, his neighbor's,—he aims at the completeness of his own little home view. And bating a few unfortunate pagodas, or sham ruins, or gothic-windowed arbors, he often achieves considerable success. There is an air of neatness, cheerfulness, and often of pituresqueness, especially where

properties afford greater scope; and in these homes views exhibit a happy
between the trim and the careless, suggesting comfort and security and
without sacrificing too much of the sweet abandonment of nature. Such
landscapes seem to breathe the spirit of our domestic virtues, while
something also of our exclusiveness and rigid assertion of individual
ı ney are closely walled in, and closely girt by guardian plantations that
ɔf the "property" may be undisturbed. It is only the man's own that
:o decorate. The breezy common may be cut up to-morrow, or a field
destroyed, for aught he cares; and we may be thankful, therefore, that
and utilitarianism combined do produce a style of home scenery
delightful and unique, and of which even the passing traveler may
and then a refreshing glimpse.

SCIENTIFIC aspect of landscape ascends from the utilitarian into higher
thought. There are few, therefore, in comparison who are competent
pleasure from this point of view. It is, however, a source of interest
in importance, and daily enlisting more votaries.

geographical relations of landscape come under this head: those cir-
which indicate its whereabouts on the face of the globe, which
.t with known characteristics of the region to which it belongs, and
its physical conditions. Much interest is derived from recog-
this manner distinctive peculiarities of climate, soil, and in what is
ırography, the arrangement of the mountain masses; the course and
ɔf rivers, and the like; and the adaptation of all to the specialties of
and fauna, and to the wants of its human inhabitants.

science can open yet richer veins of thought. Let us imagine ourselves
ɔy the side of a Humboldt, and we shall easily perceive how potent
the spell. The disclosure of the physical conditions, relations, and
ɔf what we see, as a portion of the vast system of Nature, reveals a
d to us. From the clouds above our heads, to the deep buried strata
our feet, everything assumes a new import. The clouds, with their
ıeights and conformations; the winds which bear them along; the rains
ɔr dispense, and their stores of lightning; the mountain ranges where
pnenomena of geological action are set in motion before us, and the
ıills, begin to move as in a slow dance of unnumbered ages; the
and depressions; the tidal beat and wash of vanished oceans; the
ıeat of hidden flame, or its bursting fury; the tortuous grinding of the
and the riving of frost; the wear and tear of rivers; the accumulation
ng of lakes: each of these is a revelation under the finger of science.
:he same guidance vegetation arrays itself in its appropriate climatic
and in countless orders and degrees, till to our unsealed eyes every
corner discloses its separate marvel. The very soil becomes
with significance. Every boulder stone speaks a history, and the gleam
ɔre betrays dark secrets of the rocks. Nor does animal life partake
of the same discriminating glance. Air, earth and water crowd with genera

and species, summoned into light as by an enchanter's wand, and coming to be named anew; while air, earth and water themselves become but one vast and vital whole; a system of powers, a dissolving view of ordered change; a portion of the sublime and universal cosmos.

Such enlargement of view it is in the power of science to bestow. And though there are few Humboldts to survey all nature with an equal eye, there are many who in some one line of scientific pursuit enjoy a special gift of vision. The geologist with his hammer, the botanist with his vasculum, the entomologist with his net, the conchologist with his dredging apparatus, the meteorologist with his barometer: these, and many more, walk abroad with a wondrous enhancement of perception—a microscopic intensity—which, while it reveals so many hidden treasures of detail, need not prevent the comprehension of its unity.

The source of interest in landscape which we have placed next in order is the ARTISTIC. It may be the peculiar province of the artist to appreciate this; but numbers are vividly susceptible to its influence who may have never touched a pencil or a brush, and who may have never analyzed the cause of their enjoyment.

It is due to an innate pleasure in the forms or shapes of things, in the disposition of light and shadow, and in the qualities and arrangement of color. It is evident that landscape affords a large field for the expatiation and delight of this art-faculty. The pleasure derived from form may be traced to three chief constituents—character of line, combination and opposition of lines, and proportion of parts. In all three the satisfaction is due in great measure to exact mathematical relations, of which the mind may be unconscious, but which please because a harmony or relation is felt, although its precise nature may not be understood. Musical sounds possess similar profound relations, and penetrate our being, because exact numerical relation pervades all things. But our delight in form is further enhanced by its symbolic expressiveness. Lines and shapes and proportions are all felt to be inextricably associated with ideas. They utter a language which immediately awakens sensations. Lines of peculiar beauty or forcibleness; lines diverse and opposed, and yet combining; parts related, yet differing—please the mind from their symbolic significance. They are truths in hieroglyphic, and we rejoice in the apt expressiveness of the symbol. This also may be felt rather than explained. We do not say to ourselves that such a line or shape is expressive of such a truth—that the curved line is suggestive of softness and flexibility, and the straight line of rigidity, strength and directness; but we feel it by virtue of the analogies between spirit and matter which pervade all nature; and because matter and mind are run together in the same mould—the one everlastingly answering to, and the exponent of the other.

All objects in nature are full of expressiveness in line and proportion—every leaf, flower and pebble—but landscape offers the larger and richer field. In tree stems and branches abide an infinite variety; and mountain outlines, clean cut against a pure sky, present very choice examples of lines exquisite in their own immediate contour, and of lines opposed, or in combination. Quality of line

in each separate member; a precipice in profile often yields a line of
elegance; and for combination compare the long slope of the hill
away backward with the straight precipitous front of the same, and it
present an example of expressive construction. Take such a
as that of the Oberland as seen from Berne, or of the Pennine Alps from
the Gemmi: their lines are thrown up, as it were, one against another in
combination—like tossing waves congealed. Analyze their forms, and
of mountain outline will be apparent. The interior rifts and
of mountains are also full of picturesque sweeps and breaks; but Mr.
the first to point out the peculiar beauty of the lines of *debris*, or of
lank as it descends into the valley: this he ingeniously compares to
of a bird's wing, than which there is scarcely anything more elegant,
as it is in most refined proportions of the straight and the curved—
which must enter, more or less, into the composition of every choice

nterlacing lines of successive ranges of hills, or distances, from the
to the horizon, are often exceedingly picturesque; and the contrast
by the dead flat lines of a lake, or of the sea, cutting sharp against the
always highly effective. In continental scenery the valleys are often of
instead of being rounded like the bottom of a bowl, as in our
andscapes; and the expanse of a continental plain garnished by
s striking from the contrast between the tossed and soaring lines
the level lines below.

nearer landscape affords this sort of beauty in abundance: rocks,
banks, old trees, and old cottages present the richest combina-
ine; and particularly the interlacing boughs and stems of trees, render
scenery in winter often perfectly captivating to the instructed eye.
valleys, and many pleasing bits of English rural scenery owe their
o the same endless complexity: a quality of which our artists are well
encamp about them summer after summer with amusing pertinacity.
and shadow derive their pictorial value from the same qualities of
and proportion, of which we have just been speaking. Shadows present
es primarily as variously-shaped patches distributed upon an object, or
a landscape: exhibiting, therefore, simply in their *forms*, certain
and proportions interesting and satisfactory in themselves. But
assumes a more important office in defining and relieving objects, and
"tells" with greater effect in scenery. It is this which renders the
of sunshine (without which there is no shadow) so valuable: every-
with a bright and a dark side, and stands out from its neighbor.
is why a landscape looks so much better either at morning or evening,
the light is lower and the shadows longer, throwing out every feature
strongest relief: so giving variety and boldness to the mountain side or
rock, and making every tree, cottage, or stone of value, in virtue of its
hadow. And it is this which renders the effect of our April or

October skies so delightful: streams of shadow are coursing over our and not only diversifying their often tame surfaces by alternate bands o and dark, but cutting out features otherwise undistinguishable; separating heights, distances, and particular objects,—now a tract of wood is dippe deepest purple; now a hill stands boldly out; and now a building or a tree printed off black against a sunlit background, or shines in silver upon a darkness.

Mountains owe their most magnificent effects to shadows which pour their chasms and flood their abysses block out their large proportions. sculpture their details in wonderful and sharp relief. Particularly to be are the shadows among the Alpine snows, so delicate, yet so defined, and carry ing a tender tint which defies imitation. But the mention of tint to which al shadow is much indebted for its beauty, leads us to our next element of the picturesque in landscape, namely—

Color. The charms of color are revealed to most eyes, yet not perhaps in the harmonies and subdued tones which so deliciously adorn the scenery of nature. Colors are affected by various circumstances—by opposition, by combination, by shadow, reflection, transparency, distance, and atmosphere, and for all these influences landscape affords the fullest scope. Opposition of colors must be always sparing, and concentrated chiefly into vivid specks. Nature gives us these in flowers, insects, and bright threads of cloud, in an occasionally richly-colored rock, or autumnal-tinted tree. But she is principally indebted to the works and ways of man in this respect, not so much in this country as almost everywhere abroad, where the taste for color displayed in booths, and in dresses of the peasantry bright with scarlet and blue, and the habit in rural districts of suspending colored mattresses from the windows, add wondrously to the effect of continental scenery. Here our artists strive desperately to retain the tattered red cloak of the invaluable old woman, but it will soon be too antiquated for use. They may be thankful if the modern red petticoat survives. Poppies by the hedge side in this strait are a great resource, lichens upon a rock or roof, and even a red jug or the tile to counteract our plentitude of greens. By colors in combination, we mean that rich harmonious blending of the various tints and tones which natural objects display in such abundance. Rock scenery for its greys, Scottish moors for their purples, autumn woodlands for their browns, all exhibit this harmony of colors, while a still more excellent harmony is produced by the tender admixture of various brighter and even opposing colors, refined by distance into one indescribable glow of colour. A hill side lit up by a sun-gleam often exhibits this delightful intermingling of various tints due to the bush, and heather, and sun-burnt grass, and gorse, broken rock, and soil, which are, as it were, poured over its surface in molten streams.

Shadow and Reflection, however, are important agents in blending and diffusing varieties of tints. Shadow breaks into the midst of color with cool darks, where still the original tints are seen obscurely mingling, while again it

topaz tints of Scotch or Yorkshire streams or the amethyst of lakes, but will admit the beauty of transparency.

Distance lends the highest enchantment to the view. Gradation is a of great refinement, and from the foreground to the horizon, color is on a scale of infinite delicacy. The breaks in a landscape caused by of successive elevation sometimes involve the gradation in a marked of steps, rendering the effect of distance upon color more obvious; as in the vast continental plains, the eye wanders delighted vanishing expanse. The tender blues and purples of distant mountains of loveliness, as are the soft receding azure of a sea prospect, and the everse deepening of the sky-tints from the horizon to the zenith. The distance always clear, bright, distinct, and yet soft, often defy and confound imitation. Atmosphere is in most respects only another Distance, but it may be classed separately for the effect it produces a colored medium. Two conditions of this sort are very where it is suffused with yellow sun rays, as at morning, and more evening time, glorifying the entire face of nature; and, when follow- that crimson 'after-glow' so well known to Alpine travellers, the rocks with fire, and tinges the snow peaks with colors of the

. . .

thus reviewed with as much condensation as the nature of the allow, the various elements of the pure picturesque in natural that is to say, so far as it depends upon visible shape and color—so art-faculty alone is concerned. Something will be gained if any are to look for beauties of which they have been previously un- will find a new and interesting field of observation open to them, which will never pall.

Historic of now demands our attention.

the outline of the sheltering brow, each adds a thrill to his enjoyment. are part of his long-lost self, they may have been carried in his mind's eye many a year, and have visited him in vision under far-away tropics. The scape to his eye is not what it is to other eyes, for all the soil is sacred. There few poets who have not dwelt upon the theme, and to it we have been for the most charming of their poems. It is a mood with which Nature to sympathize; she fosters it with her mild and quiet lights, her evening autumnal tints, the whisper of her leaves, the ripple of her streams, the reverberations she gives to distant sounds of cattle on the hill, or voices on the green; in the dream-like stillness she often breathes about her-

> 'How soft the music of those village bells
> Falling at intervals upon the ear
> In cadence sweet; now dying all away,
> Now pealing loud again, and louder still,
> Clear and sonorous, as the gale comes on;
> With easy force it opens all the cells
> Where memory sleeps.'

This influence of old memories deepens apparently as the features of nature with which it is associated are the more impressive. It seems to be most powerful with inhabitants of mountainous countries. The native valley is like no other valley. Its green seclusion is the one refuge which the heart seeks during all its straits and toils—cares and woes are fondly supposed never to have entered there. It is just a quiet corner of the veritable paradise; and its guardian mountains are recognized with rapture by the returning wanderer on the far-away horizon, and trod with bounding footsteps. This sentiment personal attachment has many deep and sacred sources. It is connected with the sanctities of home; with early loves and friendships; with aspirations and projects; self-communings and dedications; it is interwoven with the history of the soul. And we are apt to believe that without having experienced this early intercourse with Nature, she is never fully understood or appreciated. The born inhabitant of cities may indeed enjoy with a very keen relish his occasional runs into the country, but it is short-lived. It is principally the force of contrast which strikes him. There can be no appeal to his inner man, no delicate vibration of the chords of memory, no associations mysteriously awakened by casual sights and sounds speaking to him as voices in a dream. Nature has never been his childhood's toy-house, and he can bring to her nothing therefore of the affection of a child.

But we must turn to the wider scope of history properly so-called, and our first remark is the connection which may be traced between character of scenery, and the character and development of national life. It is impossible not to recognize this connection. Egyptian life and Greek life, Swiss life and Dutch life, the life of England and of Italy, are all intimately colored by their respective landscapes. In each instance the race has breathed in more senses than one its own atmosphere; it has shown itself the child of its soil, the inheritor of its spirit. It is as if Nature had received impersonation there in humanity; or as if

responded well to the bright alternating character of his scenery—
blue dancing sea, now the grove and plain, now the stream and thymy
There was nothing to quell or deject, but everything to stimulate energy.
the breast.

the narrow and lofty valleys of Switzerland and Tyrol, threatened by some
most tremendous powers of Nature, we find a people awestruck by
and partaking of the sternness of their mountain storms; high
as befits those who are neighbors to the avalanche, and capable of
themselves upon their foes with like resistless impetus. In the
Holland a people dwell who pursue their affairs, as they plod along their
with level and persistent energy, while the rough baptism of ocean spray
nerves of iron. The ordinary English character is unromantic—
counterpart to the tame but eminently serviceable scenery. England
is the world in little. Not equal to Greece in beauty, every tool
is provided ready to hand for the workshop. The sentimental weak-
excitability of southern continental nations seem not a little depend-
the charms of nature by which they are surrounded. True, the
of climate and scenery upon national character has been often
to the neglect of qualities of race and of moral training; but the
between the character of a landscape and that of its
are nevertheless sufficiently apparent to afford matter of much inter-
traveler. There is, however, another aspect of the same subject, and
association of landscape with national development.

appears not only redolent of the character of a people but of
Its geographical relations are the first in order. We have already
them as forming part of the scientific aspect of landscape; but
also an historical bearing, when we consider how the physical con-
have or the activities of a

remains of which most old countries are full. These are as a writing each family of men has left upon the walls of its house; venerable and sive characters, which time and the new occupants are blotting out year. But they are pregnant with meaning; and through them the scenery seems to fill with the murmur of its dead generations. The and facades of the Nile valley; the columns and pedestals of Greece and the broken walls of the Rhine castles—are all instances of this history over a landscape. How many of our own landscapes are enriched by the grey abbey walls which glimmer among the trees; or castle turret, which peers over the valley! And how much interest is the view as we learn that Cromwell in person battered the one, or that Rufus lay dead at the other!

The more extensive indications of national activity exhibited in remains, or existence of public works, as of aqueducts, roads, and other appliances of civilized life, are of similar value in imparting significance to scenery; especially where these are particularly expressive national character and habits, as in the amphitheatres and aqueducts of and the dykes and canals of Holland. In the latter case these things, in selves devoid of beauty, are so eminently suggestive, so illustrative of Dutc life—how it came to be a life at all, how it sustained itself against the both of man and of the elements, and how it grew and strengthened instead of making the dull landscape duller, they bestow upon it interest. The same may be said of the long lines of continental roads by equally interminable poplars; they are so perfectly continental, tha recognize them with pleasure. They signify to us that peculiarly feature, the boundless plain; and that centralized and systematic continental government, which goes straight to its end, without regarding or individual rights. And they bring to our thoughts the movements o armies at historic epochs; of Imperialists and Swedes, in the times of and Russians and French in the times of Napoleon, when trains of miles long rumbled on these roads, and *corps d'armee* marched, and marched. Such characteristic marks in a landscape we would not spare, and any link it may possess with an historical figure, or period, is to redeem it from the commonplace, and to compensate for tediousness. steppes of Russia are illustrated by the Cossack; the sierras of Spain b muleteer and the gipsy; the forests of Germany by the tribes of Tacitus many a mediæval incident; the bare hills of Cornwall by the ancient race; the fens of Lincolnshire as a Saxon retreat. Even Lapland and chatka achieve an interest, as they show to us the Lap with his reindeer the Kamschatdale with his dogs.

Naturally, however, no feature in a landscape can be so historically esting as a great city, seen at sufficient distance to display well its site bearing. Here history gathers itself into a focus, and makes its most appeal. The first sight of any city of renown leaves an impression not t

The whole sweep of landscape remains a vivid picture on the memory.
at first beholding Jerusalem, or Rome, have been recorded by
traveller; and in a less degree there is hardly a city on the continent
does not possess its historic charm. We say on the continent, because
surrounding natural features are larger, and necessities of fortification,
of social life, define towns to the eye much more than with us. They
way so indiscriminately into the country, through miles of character-
and in consequence they can be generally recognized at once in
significance. The eye is caught immediately with the advan-
position which first planted them there; or of defence which made
or of commerce which made them thriving; with the ramparts
stood sieges; the churches of venerable architecture; ancient
o the sky; the bridges where the craft of their rivers cluster;
ines which mark the long converging roads, and make the busy city
spider-web in the plain. And as the traveller stands and says—'So
or, 'this is Milan,' the magic of the name and spectacle together
him long in reverie, while he ponders over pages of history, which
been only pages, and never pictures.

must we omit the sites of any remarkable historical event—such
as the scenes of great battles. It is a never-failing source of interest
the formation of ground which has attracted the attention and
manœuvres of some great captain; where he planted his cannon,
his men; a point that was held as a key of position, and upon which
the fortunes of a kingdom, or the fate of a nation. Imagination at
speedily peoples the plain, or the pass, with the contending hosts—
with shouts and cries, darkens it with smoke and dust, tears up the
shot and shell, and flying wheels, and shakes it with the volleyed
—till, suddenly recalled to the harmless present, the peaceful sunlight,
cottages, the mind is startled by the almost unnatural silence and
and recovers itself to wonder where the buried bones repose!
Marengo, and many another scene of deadly strife are pilgrim spots;
so those of the antique time where only spear and shield were heard to
Sparta stood at Thermopylæ, and Athens struck at Marathon.

scenes less imperative in their pretensions may be fraught with even
sympathies. Such are the birth-places or abodes of great men—the
under some humble roof, the first small cry was heard which an-
a new voice in the world; the stream, or rock, where the youthful
was tried, which was to be a new power; the shades which nursed the
that were to issue in new thoughts! Or the scenes where such men
or suffered, or died; where they retired after life's fitful fever to rest
this world's confines; or where they gave up life; and where the
hill or stream that meets our eyes to-day, faded upon eyes that closed
Who does not feel such a landscape consecrate to genius, or to
and hush intrusive sounds to gaze his fill?

A landscape which has been intimately associated with any humar ment, which has supplied the arena for some great deed, which has bee scene of some heroic act, or the stage for a life-long or an age-long dram tell its story in every feature, will be itself the tablet inscribed forever wit record of its fame.

Let us close this portion of our subject by pointing to the most illustration of the power of history to dignify a landscape. In Dean admirable book upon Palestine, may be seen how every feature of a no wise striking landscape may become intensely significant. In harmon character between country and people, in geographical position and mation to suit their destiny, in scenes of great events, in records o departed human activity, more than all in the spectacle of such a city Jerusalem, and in the memorials of such a Life, the Holy Land is historic interest—an interest indeed far higher than historic; an interes sacred that we arrest our words. But we quote Palestine as the mos instance of history consecrating a landscape.

The Poetic closely follows upon the historical aspect of scenery, fo is concerned with whatever stirs imagination and rouses emotion. What, mer fore, can be more poetic than a landscape made living with a human and especially a human interest sunk into the silence of the past, and requires imagination to restore its life, to evoke dead generations fro tomb, to fill the scene again with weeping or with laughter, to darken o brighten it, according to the human drama once enacted there?

But every extensive prospect stimulates imagination. Let but a thi line of distance rim the horizon, and it proves a ready outlet for that faculty, which speeds away, picturing to itself the ever-receding *beyond*. misty spaces of the far-off plain, or the vista of a valley, or the leve ocean, are equally seductive; and when the setting sun gilds a landscape his last beams, the imagination of men in all times and countries has bee to follow the departing glory with fond yearnings after some remote paradis delight which may lie—which alas must lie, if it exist at all—outside th ary of our common daylight horizon.

Yet within that horizon, as we have already seen, the poetic faculty find abundant scope. The haze of distant cities raises not only the history but sets the imagination to work, picturing each crowded cente human interests and passions, joys and griefs: nay, is not a single blue fil cottage smoke wavering upward from the moorland side, sufficient to soul into poetic reverie? Upon every flowing water the imagination take directly, and faster than oar, or sail, or current can speed the bark, follow course; digressing curiously upon all the shores it visits. Or turning instead of downward, it pursues the diminishing stream till run to earth the ferns and mosses of its solitary source. And this solitariness has its mighty charm. The poetic mind seeks a spot where it can be alone wit where it may mould to itself a subject creation, and listen undisturbed to

The great attraction of mountain scenery consists in its
Even the distant forms of mountains upon an horizon are a heritage
spirits, whose thoughts roam free over their summits, or nestle
uplifted crags. Nor is the sense of mystery less enticing; the
:o wander in mazes of its own making; to suggest to itself depths
the gulfs, into which might it but look, or heights which might it
what of the marvelous and unimaginable would not be disclosed!
seas and lakes, and deserts and mountains afford ample

mind deals also more directly with Nature. Not content
and curious prying, it seeks to establish a communion as of soul
Nature face to face with herself. This tendency finds expres-
of natural objects with attributes of personality, so that
:he hill, become living beings, with whom fraternal greetings
It is difficult to resist the idea of personality in a tree.
"lady of the woods," and the oak we call "monarch of the
rivers are constantly drawing forth strains of affectionate regard.
by no means confined to poets. The passion of the German
majestic Rhine is well known, and is amusingly illustrated in
child, the son of a Bonn Professor, who flung his newly-acquired
swift current as his fittest offering, because the fullest expression
.is love and reverence for "Great Father Rhine." But perhaps
clothed with a personality yet more emphatic. Their forms
like a countenance; their hoary fronts seem crowned with

> "Mont Blanc is the monarch of mountains,
> They crowned him long ago."

apostrophized as beings of conscious might or beauty.
always uses towards them the personal pronoun, and will speak
of Glencoe" or the "Old Man of Coniston;" or, in the
still air rejoices (as one said) to hear them "talking to one an-
Byron, listening to a thunder-storm, magnificently imagines

> "Jura answers through her misty shroud,
> Back to the joyous Alps who call to her aloud!"

are yet deeper sympathies between the poetic mind and nature,
we find in the great scene of things a mysterious answering to
an affinity which we recognize when we speak of the "moods
f the inanimate world possessed emotions of its own. Moods
we transfer to it from ourselves; or rather, the scenes of nature
:o respond to our thoughts, to be the embodiment of ideas, and to
of vivid symbols illustrating our mental and moral life.
is displayed to us; *passive*, as regards magnitude and weight,
masses and repose of rocks and hills; *active*, in the forces

which are seen in movement and in conflict, where torrents dash and descend, in the rush of winds and the rack of stormy seas; and we call scenery "majestic," and "awful," as if inhabited by a spirit of gloom and Love seems to beam on us from many a fair and gracious landscape, beautiful forms and colors are blended in happy nuptials over all the earth, and earth and sky embrace in tender harmonies of tint; and such a of soft luxurious beauty—answering as to a mute appeal—we call it ' Joy laughs in our faces when we catch the bright sparkle of streams and drops, the twinkle of leaves, the dance of sprays and grasses; and we landscape animated thus with movement and with color "smiling and Peace breathes from many a calm hill-side and rural solitude, and from al horizon round when day begins to die, and the winds are hushed, and all settle to repose—and so of such a scene we say it is "peaceful," and that ' sleeps." Sorrow finds its apt reflection in many a dreary prospect, in clouds and wailing winds, in shadows falling deep and dark, in black water—and we say the scene is "sad" and "melancholy." The likeness o human life we find in the jocund youth of spring and its gay renewing o earth, in the maturity of summer and the decay of autumn. Mutability urged upon us by the changeful influences and passing aspects of every scene. And death is no less significantly enacted, when light dies—and wave, and the tree, and the flower, and when all things perish in the using!

It is not necessary to be a poet to approach the poetic side of nature. to whom expression is denied are keenly alive to poetic influences; and more have deep delight in the scenes of nature, quite unconscious that it is poetic aspect which enthralls them. They possess a dim sense of with nature; they feel that she responds to their vague longings and yearnings; or they feel that they respond to her—as if beholding a varied gorgeous spectacle, kindling now this, now that emotion, drawing out al sympathies; and they know not that all the while nature is showing them own heart, as in a "glass darkly."

We must account its poetic aspect the most refined and exquisite pleasure in beholding natural scenery. It enlarges and dignifies the personality of a man when he finds himself thus at one with nature; thinking her thoughts his breast thrilling with the sense of mystery and grandeur, as he contemplates the abysses, and the awful heights of her mightiest forms; or melting, as h surveys her scenes of lavish beauty; pensive to her mood of sadness; when she spreads before him her festal gaieties. And if he should forget Wh it is that veils Himself behind nature, Who it is that has adapted to each the outward and the inward world, and has bestowed upon them but one speec and language, even to the ends of the earth, he may easily fall into the error o the Pantheist, and dream that one soul animates both himself and the world.

The moral aspect of landscape is connected on the one hand closely wit the Utilitarian; as when a scene presents itself in its relation to the and happiness of its inhabitants; and benevolence kindles at the sight of pros

.d fertile tracts, studded with happy homes, and yielding every innocent
ınd when at such a spectacle the heart blesses the Parent of Good,
as appointed the times of man in pleasant places. And it is a moral
ıo, when nature is seen submitting to culture, subduing her wildness
e hand of man, and rendering service and companionship. It was a moral
ɔm landscape, when the charming shores of Como suggested to Dr.
eflections upon the social condition of southern as compared with
egions; and he thanked God for allowing him to gaze once and
hat exquisite loveliness for solace and delight, yet not to enervate
ɔe noble work and duty of his life.

·is also with the poetic side of nature that the moral is intimately
Poetic emotions should educate the heart as well as delight the
They are in themselves ennobling and purifying; they purge the spirit
nd sordid desires, and shame it of its petty vexations in presence
alm sublimity and ordered beauty. Nor are more direct lessons want-
.nd beauty, joy and peace should be translated into their spiritual
ınd not dwelt upon for the sake only of the pleasurable motion.
hose highest representative is not to be found either in the majestic
mountains or the fury of the elements, but in moral energy, and the
ɔf self-reliance; beauty, to whose true significance those are blind who
ɔnly in the beauteous outward show, and see not the symbol of an
oveliness and truth; joy and peace, the spiritual depths of which the
ınd the brightest scenes of nature reflect but faintly.

reading thus the symbolism of the world a genuine source of pleasure is
befitting the dignity of a moral being, who is placed by a paternal
a theatre of existence where he is called upon not only to act and to
but also to recreate himself with the glorious spectacle of material
· and in beholding which his pleasure culminates in the thought that all
have been so disposed and presented before him by Divine inten-
to image forth the Divine Artificer. For those mightiest instances of
force, in magnitude or momentum, at which he stands transfixed in
impotence of adequate appreciation, are but the shadows of an im-
almightiness; and all the lavishness of beauty spread around is but
picture of an inimitable loveliness; and the joy in which earth often
to revel, and the peace which sometimes descends so calmly on her brow,
tokens of an Infinite blessedness.

may we reckon the import to be less Divine, of all that seems dark and
in nature's landscapes. The mournful, we know too well, rightly
a sorrow which revelation more emphatically declares can ever afflict
: of God; while there is also a Divine lesson in the fact that all the
: and signs of woe are essentially transient. They are but clouds that
, shadows that fleet away, winds that wail and cease, storms that break
disperse, decays that are succeeded by renewed vigor, deaths that make
ı for life! They speak to us indeed of a mystery of evil; but they speak

of a thing which while it soils and stains is not permitted to destroy; they remind us constantly of its inevitable griefs and mischiefs, but they predict the time when creation shall be delivered from it and them together.

Any one under the habitual influence of religious feeling surrendering himself to the impressions of natural scenery will not only find its beauty and grandeur wonderfully heightened, but his own soul calmed and elevated. quiet hours of a Sunday spent among the more imposing spectacles of nature—on the ledge of some Alpine rock, or on some solitary ocean shore, are often very memorable; as the records of many good men show. And at such times the inspired aspirations of the Psalms and other of the poetic and emotional portions of Holy Scripture touch the heart with unusual force and beauty. Ascriptions of praise, and adoration of the Divine perfections seem as if uttered in the very presence of the Divine Majesty, when in immediate contact with His mighty works. He "setteth fast the mountains." "The strength of the hills is His also; the sea is His, and He made it." "The valleys also are covered over with corn; they shout for joy, they also sing,"—are words clothed with unwonted power, when the hills are there before us visibly to testify of the strength that is in them; and the valley and plain of the perfection of their beauty; and the sea of its vastness, lifting up their several voices in unison with our own.

A very familiar quotation, "God made the country, but man made the town," is so pertinent to this portion of our subject that we cannot refrain from noticing it. It generally meets with vehement repudiation, inasmuch as man being the noblest work of God, and owing his faculties to Him, the exercise of those faculties in building and beautifying a town is indirectly a Divine work also. And we are far from denying that in man's works we are to recognize what God taught him to do. Yet for purity of moral influence can they be compared with those where God alone has been the architect? Is there not a fatal propensity in man to spoil, to taint what his fingers touch? Do we not read through all his works mistake, perversion, nay, prostitution of his Divine gifts? And must there not therefore be danger to the moral sense if it be shut up among the diversified objects of man's device, imprisoned among the creations of his brain, solicited at every turn by the allurements of his raree-show?

Of all fair works of man Venice is the fairest. Yet though fully sensible to her unequalled charms, may we not feel when pacing her gay piazzas as if the oft-quoted phrase might be rendered in yet stronger terms, and that if "God built the Alps, the devil built Venice?" In no place on earth, perhaps, is man's work so beautiful, and yet so exclusive; as if especially inspired of the Evil One to become a man's paradise secure against all rebuke or warning from the divine countenance of nature. Separated by the sea from all the sweet influences of ordinary landscape, Venice knows but herself, reflected in the rippling water; while even the sea is banished from her view as a solemn and subduing spectacle, hidden as it is (to her great content) by a belt of islands, and these, not soft with foliage, but glittering with walls and towers, and so still

No stretch of field or grove affords to the Venetian the odor of gre
but he floats on his canals—not wanting in odors of their own—amo
endless palaces, churches and meaner buildings; or he sits among the crowd
benches and tables of the great piazza, where the marble pavement is nigh
filled by thousands of congenial ice and coffee drinkers. The very church
are dedicated less to God or the saints than to painters or sculptors, and th
be more fitly named after S. Tiziano or S. Veronese, than S. Paulo

The sky is the only outlet upon grander sights than man can rear; a
the glare of gas begins, and the bands strike up at every corner, the sta
a poor chance for their dim twinkling in the patch of misty dark. N
the comet—the "Stella Cometa," of 1858, flared overhead like a portent
or a veritable message from the Infinite, could a Venetian eye be tempte
than his rich facades of Palladian architecture. Great nature sets asi
Venice, and offers no lessons from her open book. Compare this life
and pavements with that of the solitary peasant of the Tyrol, and w
but believe that the latter is surrounded by influences more wholeson
for soul and body; that the glorious things which God has made must ha
bearing upon the life of the dweller in the mountain, very differe
that which the most ingenious or gorgeous specimens of human handiwo
exercise upon the heart of the Venetian citizen. And fact justifies th
The Tyrol is the most moral country in Europe, while Venice h
a reputation of quite another sort.

We have discussed the various sources of the pleasure derived from lan
scenery, and if the utilitarian, the scientific, the artistic, the historic
and moral, comprehend the grounds of that pleasure, it is yet instructiv
observe how much they intermingle, or overlap each other. The utilitaria
scientific have points of contact. The artistic is seldom dissociated fro
historic; and with the poetic it is intricably blended, all art being essentia
the nature of poetry; again, the historical aspect of the landscape is al
poetical; and further, the highest order of poetic feeling requires an elevate
consciousness.

The pleasure, therefore, derived from landscape is very complex, and n
analyzed. We experience a sweet delight, and that is sufficient for
without asking why. And yet the sensation of pleasure may be enhanc
enriched by separating and recognizing its particular components. At a
the impression will thus become at once more intelligent and lasting.

Again, the analysis we have been pursuing explains why so many differe
of scenery are pleasing; the great variety of taste in landscape; and
of particular preferences in our own times. A tame landscape may
arly rich in utilitarian, or historic interest; or a small corner of it exquis
artistic combinations; while that which is intrinsically gloomy, bleak, a
may possess high poetic claims. And varieties of taste will undoubtedl
ruled by temperament and habit, so that those whose sympathies tend mo
towards the artistic, or poetic, will appreciate what the practical man c

see nothing in; as the scientific mind will find interest in what neither can enjoy; while the man of high moral perceptions, with larger scope than any, finds "sermons in stones, books in the running brooks, and good in everything."

We would now only urge for a moment in conclusion the advantage and delight arising from cultivating the pure sources of pleasure we have been reviewing. To behold the open face of nature is a pleasure which never satiates. It is exhilarating but never exciting. Or if the more majestic scenes excite, a recurrence to the simple and near prospects is immediately restoring. Mr. Ruskin has well remarked that the way to give keener edge to our enjoyment of scenery, is not to be always seeking the highest and grandest examples, and passing from one magnificence to another, but to bring ourselves to appreciate and enjoy the humbler and simpler specimens. These are within almost every one's reach; for if our manufacturing industry too often requires to surround itself with a wilderness of its own *debris*, yet our manufacturing skill on the other hand has contrived the means of conveying the imprisoned multitudes abroad, and of showing them green fields, bright skies, and streams. This opportunity, and the growing desire to embrace it, seem destined to be the restorative and compensating means which modern life offers for its own diseases and deprivations. There is something ineffably calming and supporting in the bosom of nature, and those who seek her rightly, lay down many a burden. In her calm realm is no competition, no hurry, no strife of passion; but everything lives and grows, and passes through its ordered phases to the end; doing its work, and beautiful in doing it.

But it will add greatly at all times to our intelligent enjoyment to be able to look on the scenery of nature with every variety of insight, to be able to sharpen our vision by knowledge, and to detect all the interest that lurks in every landscape. How much does not one man actually see more than another, because he knows what to look for, and knows also all its significance? In this respect "whene'er we take our walks abroad" some acquaintance with the scientific, the artistic, or the historical aspect of things will wonderfully augment our powers, alike of observation and enjoyment, and will preserve us from the mere vulgarity of admiring only something that looks pretty; ignorant why, wherefore, to what end, and what other elements of higher virtue it may contain.

And if desirable to be comprehensive and instructed in our tastes, not less so is it to be elevated and refined in them; to be sensible somewhat to the poetic and moral significance of this varied world; to be open to its nobler impressions; to have the ear sensitive to its softer voices, to the subdued tones of its most eloquent speech; to appreciate its solemn far-reaching prophecies; to respond to its inner and almost sorrowful appeals, the groanings of a fair but burdened creation; to be elevated in fine into community of spirit with nature. Thus may we find that we have risen to a higher communion still! In any degree in which we shall be able to imbue ourselves with the beauty and expressiveness of fair landscape we shall discover that it tends, as Bacon said of philosophy, "no less to the glory of God than to the relief of man's estate."

—*British Quarterly.*

FOREST MANAGEMENT.

There is no department of literature to which the residents in a great city turn with more certainty of mental refreshment than that which deals with numerous subjects that are comprehended under the name of Forestry. change of scene and of emotion thus to be attained is perhaps more com- than that furnished by any other study. History, politics, religion, bring the mind to the very subjects of daily discussion or anxiety from which it to escape. Dramatic and epic poetry, however the perusal of the lines of the 'lofty, grave tragedians' may carry back the fancy to the habits of the heroic ages, yet hinge on the very emotions of the mind are the motives of the life which surrounds us. It is not every one who refreshment in abstract science, nor is it always the case that even the man can find rest in mere change of the details of his toil. Voyage when graphic and pictorial, may give dioramic glances at distant and scenes; but it is very rare that the traveler adds to his special that descriptive power which carries the reader along with the of the author. At the best, such a diversion of thought can only to that short holiday, on moor or trout stream, to return from the dated ticket is already in the pocket of the sportsman. Works of even if written by the pen of a master, are so brief in the interest they and so apt to be read with the substitution of real for imaginary per- and incidents, as often to fatigue, almost as much as to refresh, the And then, whether in poetry description, or imaginative fiction, how often it occur that one can light upon a book that is at once fresh and good?

The subject of Forestry, on the other hand, is so comprehensive, and so allied to what most charms the imagination, the æsthetic faculties, and intelligence, that even the humblest contributions to our knowl- of the subject possess a special charm. To the poetic fancy the very word recalls the scene of some legendary drama. Pan is not yet dead. A languor, such as that which the cool shade of lofty trees causes to the steals over the mind with the thoughts of the green canopy spread by young leaves of the beech, the solemn shadow of the pine woods, the dark scented obscurity of the orange grove. The limitation of the visible horizon is caused by forest scenery, whether in dense unbroken masses, as in the woods that skirt the Bay of Biscay, or in broken glades, as in some of the and forest-like parks of England, gives a sensation of repose. The fairy keep their last hold on our fancy, and the ruder gnomes of our German yet hold their own against the schoolmaster and the needle-gun, under shade of ancient trees.

Again, for the artist an unbounded field of delight is afforded by the forest only are shadowy vistas the special haunt of the landscape painter, but form of floral beauty finds its home in the green wood. In our own the delicacy and varied form of the foliage is the chief charm, a charm

which is absent in the more gorgeous and massive beauty of the tropical woods, as it is in the gloomy awe of the northern pine growth. The flowers of our forest trees are chiefly catkins, or flowers without colored petals. They are very graceful in their brief life, but they do not light up the green gloom with the star-like brightness of the flowers of the tropical forests. In the South of France the Catalpa hangs out a delicate white drapery on its lofty boughs, to which our Flora can offer no parallel, although we may point to the snowy sheets of blossom which cover the stunted forms of the May-thorn. But in the damp warmth which is so pestilent to the white man, not only does the vigorous vegetation of the tropical forests shoot up in spires of giant growth, but the crimson, and white, and many-colored flowers that are borne by the trees themselves, are paled and dwarfed by the extraordinary beauty, and weird and unimaginable forms, assumed by the flowers of the lianas, climbing plants, and especially of the epiphitic orchids. Nature may be almost described as attempting, in these plants, to pass from the vegetable to the animal kingdom at a bound. Scorning the earth, living like birds on the branches of the trees from which they hang down their long, scented petals, mocking the forms of the insects, without aid from whose industry some genera of orchideous plants are unable to perpetuate their species, these glories of the tropical woods seem to claim a higher rank in creation than that of terrestrial flowers.

It is not, however, in a pictorial sense alone, or even chiefly, that we speak of the charm of the study of forest life. Nor is it, on the other hand, because of those economical considerations which we shall have occasion to show to be so important. It is rather because, in his influence on forest vegetation, either as a destroyer or as a restorer, man can produce a more marked, visible, widespread, and permanent change on the planet he inhabits than he can effect in any other manner. In his influence on forests, man becomes a fellow-worker with Nature herself. He can thus wield, and often has unconsciously wielded, the wand of her irresistible power. There is nothing with regard to which we are accustomed to think that we are so utterly helpless, so entirely unable to apply any remedy but that of patient endurance, as the weather. But we learn from the study of Forestry, that however impotent may be the wish to draw a cloud over the face of the sun, or to dispel a thick veil of mist that envelopes the traveller like a sheet, if we look to the moment alone, it is altogether within our power, with the aid of a little time, to change the climate of a country. Patient toil, directed by that skill which is part of the heritage of the forester, can produce shaded springs in a dry land, and water brooks in the desert. Angry impetuosity, ignorantly aiming at undue gain or hot revenge, may convert, and in many places has converted, land famous for abundant fertility into arid waste. The ruthless exterminator of forests modifies not only the productive character, but the climatic condition, of wide ranges of country. Had we the power of depicting the aspect of the earth, as it must have been apparent, age after age, to any observer on the nearest planet, we should recognize at one time the presence of a greenish lustre, such as that which is supposed to

denote the presence of large forests in Mars, and at another time the preva
of a paler shimmer, like that which is reflected from the waterless cinders l
the volcanoes of the moon.

As this power of the secular modification of climate is that attribute
craft of the forester which most readily fires the imagination, so must the n
of exerting that power be regarded as an ultimate outcome of his toil.
that which finally represents the value of his work. The details which
necessary to master, before we come even within sight of that goal, are num
and important. If we watch the requirements of the forester as they occu
by one, we shall find that we omit but few of the elements of a polite educ
It will be, we hope, both interesting and instructive to glance at those req
ments, and to see what steps are being taken, in our own colonies and dep
encies, as well as in other parts of the world, to train a body of men who
be, both theoretically and practically, adepts in forest lore.

The area over which the experience of the skilled forester extends is
wide, whether regarded according to its geographical range, or according
physiological extent. From the high-water line of our tidal seas—from
lower level at which the scrub of the Ghor is washed by the rapid torrent
Jordan, 1,200 feet below the surface level of the Mediterranean—to the
level of perpetual snow on lofty mountain ranges, each orographic provin
zone of vertical ascent, has its appropriate Flora. The forester mu
acquainted, not with timber trees alone, but with at least as much of the or
world as is connected, whether in a friendly or in a hostile mode, with
growth and welfare. As to actual trees, the range in size extends fro
minute form of the Alpine Willow, which we have picked on the sumi
Skiddaw, of less than three inches in height, to the lofty column of the ma
Wellingtonia, which towers, in the Giant Yosemite Valley, to an altitude
feet. A height of 200 feet is attained by the Umbrella Pines of Italy
Sclavonia the Sapin (*Abies pectinata*) attains an ordinary height of 275
The *Eucalyptus Amygdalina* is described by Dr. Mueller as attaining
banks of the Yarra River, in Victoria, the height of 420 feet in many inst
The California Big Tree is said to measure 96 feet in girth. In length
and rapidity of growth the diversity is no less marked. A *Pinus sylvestris*,
Finland, 70 feet in height and 72 inches in girth, has been found to regist
passage of 518 seasons by its concentric rings. The venerable Yews that
a majestic avenue at Studley Royal, or the yet more magnificent patriar
the same species that form a kind of Druidic circle in the sequestered and
tiful glade, near Guildford, known by the name of 'Fairy Land,' must have
in existence when the wood of the yew decided the fate of battle, in Norm
even in Saxon times. The *Eucalyptus globulus*, on the contrary, rapidly a
gigantic dimensions. It has the property of absorbing ten times its wei
water from the soil, and of emitting antiseptic camphorous effluvia. When
in marshy ground it will dry it up in a very short time, according to the evi
collected by M. Gimbert, mentioned in the 'Medical Times and Gazette.

the spring of 1867 about 13,000 of the Eucalyptus were planted at Pardock, twenty miles from Algiers, in a plain situated on the banks of the Hamyze, and noted for its extremely pestilential air. In July of the same year, being the time when the fever season sets in, not a single case occurred; the trees were by that time nine feet high. Notwithstanding this rapidity of growth the wood is of great strength and tenacity; and is to be obtained in any lengths. The *Eucalyptus rostrata*, or red gum, again, is a hard dense wood, almost indestructible in water, or in damp ground. The wood of some amentaceous trees, and even of the Coniferæ, is converted into pulp for the manufacture of paper; and a Japanese tree furnishes a pulp for this purpose which more resembles gelatine than ligneous matter in the ease with which it can be manipulated.

The general problem of the distribution of trees and other plants over the surface of the earth was not only unsolved, but unstated, before the time of Linnæus. Even now we are apt to forget, in mentioning that illustrious man, the mode in which, in his *Philosophia Botanica*, he indicated the course which has since his time been followed by the most eminent continental botanists, more especially by the Decandolles, both father and son. The first principle of distributive, or geographical, botany is, as in the animal kingdom, that of the development of the species in proportion to the dose of heat. In vegetables this dose is derived from the sun alone. It is thus a question of *habitat*. The more directly the rays of the sun strike the surface of the earth, and the more dense the atmosphere which they penetrate, the greater is the amount of sensible heat and light. In moving from the equator to the pole we experience a diminution in the sensible influence of the sun's rays, which very closely resembles that which is felt in ascending a lofty mountain. Thus while the Equatorial Flora is limited to a narrow belt of earth, the Arctic or the Alpine Floras, the plants of low latitudes and those of great altitudes, are akin, or even identical. Eight successive zones have been pointed out, each of which may be roughly described as determined by an isothermal line dependent on the combined influence of latitude and of altitude. In regarding both the northern and the southern hemispheres, the number of zones will be increased to fifteen; although, from the unequal distribution of land and water, the area for vegetation is far less, and the isothermal lines are nearer to the equatorial level, in the southern than in the northern part of the globe. These fifteen zones have been divided by Professor Schouw into twenty-five botanical regions, each of which is defined, not by geodesic or photometric considerations, but by the observed prevalence of certain known families of plants.

In the Polar zone vegetation is confined to the Alpine plants, which rise but little above the level of the soil. Mosses and lichens reach to the snow-line. The Arctic, or Sub-Polar, zone is the zone of rhododendrons; which Dr. Hooker has found in the Himalayas at from 7,000 to 10,000 feet. The Befarias, which in the New World represent the Rhododendrons of the Old, rise to the height of 13,420 feet on the Andes of Quito, or 120 feet above the mean limit of shrubs. 11,400 feet will be the mean limit of the region of pines, which suc-

ceeds that of rhododendrons. This elevation is attained by the oak (*Q* *semicarpifolia*), on the south side of the Himalaya Mountains; while on north the birch (*Betula alba*) grows as high as 14,600 feet. On the Pyre the *Pinus uncinata* is found at 10,870 feet. On the Andes of Quito the Escal occurs 11,500 feet above the sea. The Sub-Arctic zone of the pines is ceeded by the cold temperate zone of the European trees. The warm temp zone, that of the evergreen trees, follows; then the sub-tropical zone, of my and laurels; the tropical zone, marked by tree ferns and figs; and finally Equatorial zone, which is the region of palms and bananas.

The distribution in longitude of the various local Floras must be reg is an observed fact alone, as to the original cause of which science has been unable to afford any indication. Why the Asters and Solidagos in N America should occupy the region filled, in a zone of equal temperature i Old World, by the Labiatæ and Caryophyllaceæ, while the same temperat rom 52° to 72° in Australia and Tasmania, calls to life the Epacrides Eucalypti, we have yet to learn. The law of the localisation of t amilies of plants is one of the most important objects to be ascertain d, only by the student of forestry, but by the physiological botanist.

The economic value of the products of Forestry is of the very first im ance. Even considered as a matter of import and export, under which a it is possible to arrive at a comparative estimate of the actual commercial m ments caused by this great industry, this importance will be manifest. B absolute necessity of forest products, as the material for, and very mainl of, other industries, is far more vital to our civilization than it is possible t way to indicate by the tonnage or money value of the imports. No adeq substitute can be found for wood. For one purpose, indeed, that is for fu mineral relics of primeval forests have for a time almost superseded the pro of contemporaneous vegetation. Nor is it probable that in the lifetime of existing generation there will be much change in this respect. But it must borne in mind that however great be the supply of coal in any country, or the whole coal measures of the earth, it is a limited and a definite quantity. is a provision which, if constantly sought, must come to an end sooner or la It has no reproductive power. To an ordinary appreciation it may matter li so that we are unlikely to witness either the exhaustion, or the panic of exh tion, of our own coal-fields in our own time, by how many centuries consumption we may gauge the coal supply of the world. Such will not be case with the statesman or with the philosopher. To the man who loves country, who seeks to serve her, and who desires to leave to history the nam statesman or of patriot, it must be already evident that the optimist and pessimist views of the durability of our home coal supply are alike extravag Whether we accept the highly-imaginative estimate (if it can be called by business-like title) of the Commission of 1871, of a possible supply of (90,0 000,000) ninety thousand millions of tons, reaching down below the surface our island to a depth where the temperature exceeds 122° Fahrenheit

whether we take that practical correction which, by excluding coal that, if it exists, would be impracticable to win, reduces that quantity to little more than a third, little matters to our present argument. In the latter case our coal-fields would be exhausted, allowing consumption to increase as it has hitherto done, by the year 1945. In the former case the term has not been suggested. But a century sooner or later in the history of a great nation is a matter of comparatively little importance, when it is a question of the displacement of the very centre of gravity of its industrial condition. Again, it is true that the coal-fields of the United Kingdom amount to only some four per cent. of the coal-fields of the world. But this disproportion is not greater than that which exists between the population of the United Kingdom and the population of the world. And even if we strike off the enormous number of the non-industrial, non-coal-burning part of the human race, we still are forced to the conclusion that a result which may be due in one or two centuries in England, and which may be possible in three or four times that length of time in the whole world, is not one which the statesman can afford to ignore. At a period of time not greater than that for which Westminster Abbey has stood (dating, not from the Confessor, but from its rebuilding under Henry III.), it is probable that the coal supply of the world will have been rifled of its cream. If by that time the forests of the world are also destroyed, the future will have a gloomy outlook. Those forests, wisely managed, are adequate to keep the human race in fuel; but if destroyed at the rate at which destruction is going on in some localities, it will be as impossible to restore them as to win back the coal that has been consumed.

Considering the incalculable amount of national advantage, or loss, that must result from the skilful or unskilful management of our vast forest-property, and, indeed, from the whole of our Colonial arboriculture and agriculture, our readers may expect to hear that the due education of a class of men fitted to be the guardians of such imperial treasures has been carefully provided for by our Government. So long ago as the time of Queen Elizabeth, the student of English literature is aware, the importance of a study of vegetable culture was insisted on by a great writer, who labored, as few since have done, for the advancement of knowledge. 'God Almighty,' said Bacon, 'first planted a garden.' On the key-note thus struck depends the tone of the entire treatment of the subject by the restorer of modern science. The imaginative beauty of Bacon's views is not more striking than that clear insight of genius which has pointed out the value of a thorough study of natural history as the very backbone of a liberal education. No parent or preceptor, who has taken Bacon's advice in this respect, has ever, we will venture to assert, found cause to regret having done so. How far has this advice been followed with reference to our public service?

Forestry, which holds on the Continent an honorable and even a distinguished place amongst the branches of a liberal education, is in this country, according to the great authority of Dr. Hooker, 'a subject so utterly neglected that we are forced to send *all* candidates for forest appointments in India to

France or Germany for instruction, both in theory and in practice.' 'Where the English rule extends, with the single exception of India, the same apathy or at least inaction, prevails. In South Africa, according to the Colonial botanists' reports, millions of acres have been made desert annually, through the destruction of the indigeneous forests; in Demerara the useful timber trees have all been removed from accessible regions, and no care or thought given to planting others; from Trinidad we have the same story; In New Zealand there is not now a good Kandi Pine to be found near the coast; and I believe that the annals of almost every English colony would repeat the tale of wanton waste and improvidence.'

'The average of first-class teak trees found in a normal uncut forest,' Beeling," according to the Report of Dr. Brandis, Inspector-General of Forests in India, 'was fourteen per acre; while over the entire area of Government teak-forest lately taken into management at Maulmain, 552 square miles in extent, the first-class trees which remain standing are only fifteen in ten acres, while stumps and damaged trees everywhere abound. The Sal forests of Upper India might be shown to be even in worse plight, through reckless cutting and utter neglect. There were in 1830 probably 4,000 miles of purely Sal forest along the foot of the Himalayas, besides those in Central India available to Government. The Sal timber is almost the only one found capable of standing the Indian climate for railway uses; yet now the East India Railway has been obliged to import pine sleepers from Norway, Sal being scarcely procurable.'

In the year 1830, out of a total area of sixty-six millions of acres, comprising in New Zealand (being about six-sevenths of the area of the United Kingdom) twenty millions, in round numbers, were under forest. In 1868, the forests had sunk to fifteen millions of acres; in 1873 to twelve millions. Stated by percentage, the 30 per cent. of forest existing in 1830 had sunk to 28 per cent. in 1868, and to 18 per cent. in 1873. The first thirty-eight years had witnessed the diminution of woodlands to the amount of one-fourth, but the last period, of only five years, had seen a further destruction to the amount of one-fifth of the remainder! or at the rate of 4 per cent. per annum. At this rate the entire woodland of New Zealand would be destroyed by the year 1900.

Dr. Hooker wrote the remarks which we have quoted in 1867. Every time when we reproduce them, the daily press echoes complaints of the wasteful destruction of timber in our few remaining English forests. It is satisfactory to find that, in any corner of the British Dominion, the science of forestry is receiving adequate attention. It is from that colony in which, more thoroughly than in any other part of the world the English race has struck vigorous root—that island which, from its congenial climate, promises to become the Great Britain of the Antipodes—that the first vigorous protest (with the exceptions above referred to) against wanton forest-arson has been raised. We have before us a volume of papers relating to State Forests, their conservation, planting, and management, presented to both Houses of the General Assembly

*Reports on the Paris Universal Exhibition, 1867. vol. v. p. 57. Mr. Webber on Forestry.

in New Zealand, by command of His Excellency the Governor; together with report of the very able speech of the Hon. J. Vogel, delivered in the House of Representatives on July 14, 1874, on moving the second reading of the New Zealand Forest Bill. We cannot do better than avail ourselves of the careful research by which Mr. Vogel has brought together so much definite and pertinent information on the important questions of the rapid exhaustion of ancient forests, and of the pernicious effects thus produced on climate and on vegetation. But while, as a literary *precis*, the speech in question has a singular value, the imagination is more impressed by the vivid picture of the actual state of the newly-settled parts of the globe, than even by the statistic calculations. We seem to hear the axe ringing through the wilds; to watch the progress of the flames as they crackle through hundreds of miles of forest. We become aware that, as we write, irreparable destruction is in full career. We see how slow, feeble, and ineffective is the progress of the planter; how rapid that of the desolater; how clear the duty of preserving that which centuries cannot replace. We witness the operation of causes which, in our part of the world, have been comparatively inoperative since the overthrow of the Roman empire. We see a patriotic statesman pleading for the preservation of the greatest natural blessing of his country, and we draw from his words a lesson that should be deeply taken to heart by us all.

It is no easy matter to form a clear and accurate idea of the forest wealth of the world. Data are wanting in many places, and the information which is accessible has been compiled with so little reference to any but special utility, that the very points which are of most general interest are often omitted, as if of set purpose, from returns. Again, it is often not so much from the want of arithmetical data as from the difficulty with which the mind realises the value of enormous numbers, that our want of general grasp arises. Writers are too apt to pursue inquiries into a degree of detail that is altogether unprofitable, from a philosophic point of view, owing to the doubt that hangs over other portions of a subject of which they only examine particular branches. It must be, therefore, by the widest collection, and most simple grouping, of facts, and by a comparative, rather than by a positive, statement of results, that we can most intelligently seek to present this great field to the imagination.

The forests of Europe are estimated, by Dr. Brown, as covering 500,000,000 of acres, or nearly 20 per cent. of the surface of the Continent. In British North America, the average given by the same authority amounts to 900,000,000 of acres; in the United States to 560,000,000 of acres; in South America to 700,000,000 of acres. The total thus estimated, for Europe and America alone, is equal to 3,600,000 geographical miles, containing 736 English acres each. If we regard these forests as productive of fuel alone (as, sooner or later, it is to actual forest growth that mankind will have to look for a permanent supply of fuel), it is instructive to compare the area and products of the woods, with those of the coal-fields, of the world. The total area of known coal measures is estimated by M. Simonin at 25,000 square French leagues, or 1,600 hectares.

This is equivalent to 134,000 geographical miles. Four-fifths of this area within British and American territory, in North America; one twenty-fifth i the United Kingdom. It follows that the estimated area of the European American forests is nearly twenty-seven times as large as that of the ascertai coal measures of the world.

The English coal measures which are in full work cover somewhat m than 5,000 geographical miles. The coal raised, in 1869, was 108 000,000 tons, of which about 10 per cent. was exported. Something more than 2 of tons of coal is thus annually won from a geographical mile of coal mea n full operation. The yield of our coal fields, during the periods as to wh exact returns are in existence, rose from ten millions of tons per annum he beginning of the century, to ten times that amount in 68 years. If same ratio of increase be maintained, our known supplies, down to the dept 2,700 feet (at which level the temperature is that of blood heat, and la ceases to be available), will be exhausted in the year 1945. This will give approximate period of a century and a half for the life of a given coal-f of large dimensions.

The actual yield of those forests which are now in course of system culture and working in Europe varies to a great extent. In the most unfav able districts of Prussia it is as low as half a load of timber per acre, annum. In Baden it is four times that amount. The latter ratio is calcul on areas actually under crop; the former includes large districts of waste moor. As we advance towards the equator, the forest products become m important as regards the size of the trees, the rapidity with which they gr and the density or specific gravity of the timber. A specimen of *Pinus syl* from Finland, sent to the Vienna Exhibition of 1867, grown in 60 deg. 5 north latitude, measured no more than 70 feet in height, and 72 inches in g when 518 years old In the teak forests of British Burmah it is calculate Dr. Brandis that the stock may be entirely replenished, under proper man ment, in 120 years. First-class trees often attain 15 feet in girth. A poiso *Antiaris* is described 38 feet in girth, and 250 feet high. The teak is said attain a height of 32 feet in two years. The specific gravity of Riga fir is that of teak, 0.66 to 0.88, that of the swamp oak of Queensland, 1.24. T if we take the rate of annual production of wood actually attained in B (which is less than the weight of hay that can be grown on an equal area, u favorable circumstances, in England) as an average of forest productio shall be very far within the mark. From three to four loads and upwards acre per annum, would probably be nearer the truth than two loads. Limit our estimate, however, to the lesser figure, we have an approximate yield 1,500 loads of timber per geographical mile of forest, per annum.

We have seen that a yield of 20,000 tons of coal per geographical mil now attained in our own coal-fields. It is unnecessary to go into the ex arithmetical mean of a yield which has increased 75 per cent. in 14 years; actual rate is ample for the purpose of comparison. Subject to such corre

as may be due to the different quantity of carbon contained in a load of wood and in a ton of coal, which depends on the character of the wood, the product of the coal-field is seven times as much, per mile, as that of the forest. To produce a yield of fuel equal to that obtainable from the known coal measures of the world, if worked with an activity equal to that of our own, seven times the area of cultivated forest is required. But the actual area, as estimated, is not seven, but twenty-seven times that of the coal measures. It is thus four times as important, regarded as a source of fuel. But while the life of the coal-field has been taken at 150 years, that of the forest, if rightly cared for, will endure as long as that of the human family.

A wealth such as this is not to be measured in tons of gold. Immense as it is, if considered only as a source of fuel, its value is far higher if we consider the nature of some of these arboreal products which form nearly one-seventh part of the total value of our imports. The products of tropical forestry and arboriculture are among those objects which give luxury its chief resources, and life some of its most cherished enjoyments. To restrict our consumption to the vegetable products of our own shores, or even of Europe, would be to return to barbarism. It is very possible that the physical vigour and manly bearing of Englishmen would be improved if we were compelled to substitute the beer of our own growth, for the tea, coffee, and cocoa (to say nothing of the wines and the spirits) of warmer climates. But what would become of our intellectual and literary activity, under a return to the diet of the Plantagenet times? How would the rate of living—that acceleration of speed which in the United States is so far in advance even of our English rapidity—be checked by the more sedative diet? It may be urged that such a change would be desirable; but no one could dream that it would be possible, except under the direst necessity.

We have, however, only estimated a portion of the existing forest wealth of the world. The proportion of the woodland to the whole area of Europe is estimated at 20 per cent. In America the ratio is 21 per cent.; in the United States, alone, the estimate of Dr. Brown was 25 per cent.; but by 1870 the proportion had fallen to 15 per cent. In New Zealand we have seen that the 32 per cent. of 1830 had shrunk to 18 per cent. by 1873. If we suppose that the forests of Asia, Africa, and Australasia bear the same common proportion of 22 per cent. to the area of the land, we have a further spread of forest, raising the grand total of the forests of the world to 7,734,000 geographical miles, or nearly fifty-eight times the area of the known coal measures of the world.

While a great range of this extent, if duly cared for, and wrought with an eye to the future, no less than to the present, would thus be ample to supply every need of a far larger industrial population than we can readily contemplate as living in those parts of the world where skilled labor finds its natural home, no assumption can be more erroneous, more foolish, or more mischievous, than that the supply, however vast, is inexhaustible. The very contrary is the case. The rate of exhaustion of forest, where we are able to measure it, has been so

rapid, and so constantly increasing, as to cause the gravest anxiety. It mu remembered that we are living at the commencement of the most stupen revolution that the world has ever witnessed. It is not a political, but an in trial movement of which we speak, and an industrial movement attende unexampled physical results. By the use of machinery, moved by heat, an the most convenient mode of managing heat yet discovered, driven by st we have shifted the centre of gravity of human labour. We are multipl our new servants, the drudging goblins of the steam engine, at an enorn and ever-increasing rate. The discharge of all the heavier kinds of labo all civilized countries, will soon be effected, we cannot doubt, by mecha power. With the freedom thus given to the hand of the skilled mechanic inventive power is allowed fuller play. Each new process, each impr manufacture, stimulates the energy of consumption. The rate of our own duction of coal, which has increased, between 1800 and 1869, from 10,000 to 108,000,000 of tons per annum, is the best gauge that we can presen measuring the rate of the increase annually taking place in the industrial act of the world. Nor do we see any probability that this increase will be che unless by great international or national convulsions.

A diminution of 40 per cent. in the forest wealth of America, from the estimate of the area to the year 1870; a diminution of 40 per cent., not in estimated, but in the admeasured, proportion of forest land in New Zeal between 1830 and 1873; a waste of the Great Sal Forests of India to such extent as to render necessary the importation of railway sleepers from Nor an increase in the demand for fuel, in Great Britain, at the rate of 1,100 cent. in sixty-eight years; are so many salient proofs of the rate at which destruction is making way. These instances are not exceptional; wher colonisation or settlement is taking place throughout the world, that is to wherever the timber supplies of the world are being opened to commerce same wanton waste is going on. It is not too much to say that in a per sixty years (not long before the 2,700 level may be expected to be reache our coal-fields), the accessible forests of the world will have become thin the past, unless a firm check be put to the ravages of the destroyers.

It is not easy, it is not always possible to renew extinct forests. U some circumstances planting can be resorted to with success; but the outcome of forest experience is to the effect that the systematic care of self seedlings, and the thinning of the young growth, year by year accordi definite plans, is the true method of providing for forest reproduction. T we find that

"In 1839, Mr. Williams, dockyard manager, reported to the Bom Government that in twenty-one months 40,000 teak trees, between twelve in and six inches in diameter, had been floated down by the contractors (in Travancore Forests) who had been allowed to act indiscriminately, and the supply of large timber for ship-building was scanty. The prospects of production of the teak trees had become so bad through this neglect,

Government was advised to purchase 260 square miles of forest land for replanting young teak for the use of the Government dockyards. This was actually done in 1842. Several plantations were attempted, but it was found that the expense of planting an acre with teak was greater than the value of the timber likely to be produced, after 100 years, on a square mile!"

"The British provinces of Malabar, Canara, and Googerat, Bombay, Madras, Rajamundry, Coimbatoor, and Cochin, containing teak forests of vast extent, stocked with first-class trees fit to cut, and a natural growth of young trees reproducing themselves, and capable, with proper management, of yielding an ample supply without any chance of deterioration, had in these thirty years been given over to destruction."

Again we find that in 1842, when the Government were made aware of the destruction which they had allowed to take place in Burmah, plantations of teak were formed in Attaran to remedy this evil. The teak was found to grow freely from seed; but so little care was taken of the seedlings that in 1845 only one tree was found alive. "Dr. Brandis calculates that in order to make teak plantations profitable after sixty-two years, the total outlay per acre should not exceed sixty-seven rupees. The actual outlay was, however, over 600 rupees per acre, so that Government planting, as a method of restoring the exhausted forests, is a failure"

We should remember that the great demand which must hereafter come upon the forest reserves of the world for fuel is as yet comparatively unfelt. In the United States, indeed, the 60,000 miles of railway now in use, or soon to be completed, make a steady annual demand for combustion, as well as for construction. To give 2,500 sleepers to the mile these roads require 150,000,000 of trees, each tree making generally but one sleeper. These sleepers require renewal every five years; making a demand for 30,000,000 of trees per annum. The estimated distance run each day by trains on all the roads is 308,000 miles. Each engine, with an ordinary train, consumes about one and three-fourths cord for every twenty-five miles. This gives an annual consumption of 6½ million cords of wood. The 60,000 miles of railway require, at the rate of forty poles per mile, 2,400,000 trees. These also decay, and will require renewal. The demand for lumber increases at the rate of 25 per cent. per annum. The fences of the United States are now valued at 1,800,000,000 dollars, costing 98,000,000 dollars per annum for repairs and renewals. These are chiefly of wood. In 1871, 10,000 acres of forest were stripped of their timber to supply fuel for the single city of Chicago. 63,928 establishments, employing 393,378 persons, and using material to the value of 310,000,000 dollars per annum, were engaged, in the year 1869, in manufacturing articles entirely from wood, in addition to the number of 7,439,840 persons partly employed on wood, and using annually wood to the value of 554,000,000 of dollars. The estimate given by Mr. Hough, cited in the speech of Mr. Vogel, of 1,000,000,000 dollars per annum as the value of the products drawn from

the forests of the United States, falls nearly one-third short of these enu rated items, without taking count of the consumption for the railways.

In England, and to some extent on the Continent, the comparative ch ness of coal has arrested the consumption of wood as fuel. But this protec is rapidly disappearing. The question of fuel is one which is preemine decided on economical principles. The actual cost at which a given quan of steam can be produced by the consumption of wood, or of coal, wil found to regulate the choice of combustible. As the price of coal i whether through increased cost in winning, or from that alarm as to the haustion of our coal-fields which has already produced a serious, and prob a permanent, advance in the market rate, the substitution of wood, in part o whole, becomes more practicable. It may be interesting to glance at the tive calorific value of the different species of fuel, as this will enable us to a tolerably clear opinion as to the prospects of our supply.

A cubic foot of fir timber weighs from 30 lbs. to 44 lbs., according to quality of the wood. A cubic foot of good coal weighs from 77 lbs. to 88 The evaporative power of absolutely dry wood is expressed by the power that of pure carbon being 15. The evaporative power of the best qualitie brown coal is 12, that of bituminous coal, from 14 to 16; that of anthra 15; that of inferior coal, as low as two-thirds of that of good coal. The of rough timber contains 40 cubic feet; that of hewn timber, fifty cubic Thus the evaporative power of a load of rough dry fir will not exceed, and hardly equal, that of a quarter of a ton of good bituminous coal. Wher price of a ton of the latter is equal to that of four loads of the former, economic value of the two will be equal.

The lowest price that we have seen, in any of the works before us, qu for timber for fuel in England is sixpence per cubic foot. But this includ large proportion of the price for rent, or royalty, and profit. In the fores Baden, where water slides are used for the conveyance of large rafts of ti "the *Forstverwalter* is enabled," reports Captain Campbell Walker, "to slip, and float the trees to a depot at a cost of 4 kreutzers, say 1½d. per foo round." This cost is divided into felling, 1 kreutzer; slipping, 1½; floating In Hanover, according to the same reporter, the price realised for the thinn of the beech woods, cut into billets and piled ready for sale as fire wood, low as 1¼d. per cubic foot. The specific gravity of beech is greater than of average fir, a cubic foot weighing 43 lbs. The calorific value of a foo hewn billets will be thus fully one-fourth of that of a ton of coal. Forty c feet of beech are sold for five shillings. The best coal could formerly obtained at the pit's mouth in many parts of the English coal-fields at 4s per ton. Those days, no doubt, are over, but the comparison indicates the where the cost of each of the two descriptions of fuel is at the minimum.

The average price of our exported coal in the year 1869, just before rise in price commenced, was 9.61 shillings per ton. In 1874, according to last returns, it was 17.28 shillings per ton, and thus about equal to the calo

value of wood at 1⅛d. per foot. But we find the price of fir in the Earl of Seafield's woods in Strathspey rated at 6d. per cubic foot, larch being twice that price. The average value of the hewn timber imported into the United Kingdom in the year 1871 was 56.8 shillings per load, or 13s. 6d. per foot. It is clear, therefore, that the price of coal must continue to rise until it attains something like four times the actual export value, before we are likely to see the introduction, on any large scale, of timber as a competing fuel.

That the wood burned on the American railways may be nearly as cheap as that of the German forests, and that, so long as this cheapness continues, the rapid waste of these forests will continue to supply it, there can be, we conclude, little room to doubt. The comparison enables us to form some idea of the enormous impulse that has been given to industrial development in this country by the opening of her coalfields. Fuel was long supplied at a rate far more reasonable than the cost of labor required to help oneself to timber, if the woods were common property. This impulse was given at the very moment when it was most effective. In the early state of our knowledge of the steam engine, a costly supply of fuel would have retarded, or altogether strangled, the progress of invention. We are now so familiarized with the use of mechanism for saving labor, and are making such daily progress in its excellence, that we can afford to contemplate the prospective rise of the price of coal till it arrives at eighty shillings per ton without any very serious alarm; if only that rise be unaccompanied by panic or financial convulsions. A rise of an equivalent amount, quadrupling the price of the material, has already taken place within our memory; and a prodigious increase in the activity of every department of industry has been concurrent with that rise.

While the rate at which the forests of the United States, and of parts of our own territory, are being laid waste, is so rapid, and while the inducement to continue that waste, at least so far as the cutting of fuel and of lumber is concerned, is so great, it is certain that no power but that of legislation will be able to check the progress of destruction. The prospect that, at the time to be measured by tens of years, or even by generations, the woods of any country will be exhausted, will have but little influence on the dealer in fuel. It is desirable to inquire what further evils may result from the destruction of forests, beyond waste in the supply of fuel, and destruction of the sources of future supply.

The evidence is conclusive to the effect that the destruction, or undue removal, of forests has a marked and prejudicial effect on climate. Dr. Hooker writes to the Earl of Kimberley, under date May 27, 1873:

"It is principally on climatic considerations that the cutting down of forests seems to require Government supervision. There is good reason to think that in tropical countries the removal of wood operates effectually in reducing the rainfall. There can, at any rate, be no doubt that the presence of forests plays a most important part in storing the rainfall, and yielding up gradually to the

streams a continuous supply of water; a thing, I need hardly say, in a country of primary importance.

"Moreover, the rain is retained by forests on the surface of the ground gradually permeates to the sub-soil, and so feeds the underground water-bear strata, upon which springs and wells must eventually depend. If the fores indiscriminately removed, the rain runs off as fast as it falls, and washes av the superficial and fertile soil with it.

"I have lately received an account of the deterioration of the climat some of the Leeward Islands, which affords a melancholy confirmation of w have urged above.

"The contrast between neighboring islands is most striking. The which has befallen the smaller ones is, without any doubt, to be ascri o human agency alone. It is recorded of these that in former times they w with dense forests, and their oldest inhabitants remembered when were abundant, and the hills and all uncultivated places were shelte y dense groves. The removal of the trees was certainly the cause of resent evil. The opening of the soil to the vertical sun rapidly dries up noisture and prevents the rain from sinking to the roots of plants. The r easons in these climates are not continuous cloudy days, but succession sudden showers, with the sun shining hot in the intervals. Without shade u the surface, the water is rapidly exhaled, and springs and streams diminish."

Mr. Vogel cites a report by Mr. Hough, President of the United S Association for the Advancement of Science in 1871, which refers to the p ful accounts which the journals were then giving of the distress of India famine, and of the exertions of the British Government to prevent the starva of thousands of people. "From a careful study of this subject Mr. H writes, "with such data as are accessible in late reports, we cannot doub this calamity is largely due to the fact that the forests have, within recent ye been swept off by demands for railroad and other uses much more rapidly t formerly, and that the exposure to winds and sun, thus occasioned, may h largely contributed to these painful results."

In Eastern Ohio, William C. Bryant gives evidence that "it is a comm observation that the summers are becoming drier, and the streams sma several rivers showing a considerable decrease in navigability during the fifty years. The summers are hotter and the winters are colder." Th referred to the destruction of the forests along the tributaries of the Missis

Valencia, in South America, according to Mr. C. H. Granger, was form 'situated about one mile and a half from a beautiful lake, which was rounded by a dense forest. The trees were cut away, and in course of the waters receded to the distance of four miles and a half. The trees w afterwards replaced by others; and in about twenty-two years the lake retur to its original boundaries."

"From all parts of the State" of Maine, according to the Report of Commissioners of Agriculture for 1869, "come up the same complaint of

diminished volume of water in the streams, occasioned by clearing up the forests and denuding the hills of trees. The snows are not so heavy nor so frequent as they were twenty or thirty years ago; and there is less rain in the summer. Many of the old trout streams of twenty years ago are now completely dry, and several parts of the State suffer more than formerly from drought. Snow covers and protects the ground with less regularity. * * * The first settlers in the counties of Kennebec and Oxford raised good peaches in abundance. The fruit retired gradually from Maine, quitted Southern New Hampshire, lingered for a time in Massachusetts, and has finally been driven from all New England, except some favored spots where shelter has been provided. * * * The same causes materially affect the more hardy apple."

Some twenty-five years ago the Danish island of Santa Cruz was a garden of freshness, beauty and fertility. Woods covered the hills, trees were everywhere abundant, and the rains profuse and frequent. A recent visitor, who sought the island, with which he had been familiar in the time of its greatest beauty, for the sake of botanical study, a year or two since, found a third part of it reduced to an utter desert. The short copious showers had ceased, and the process of desiccation was gradually extending over the island. An attempt to restore the former fertility by means of planting was made too late. One planter had set a thousand trees, but every one of them failed.

"The island of Curacoa was," again says Mr. Hough, "within the memory of living persons a garden of fertility, but now whole plantations, with their once beautiful villas and terraced gardens, are nothing but an arid waste; and yet, sixty miles away, along the Spanish Main, the rankest vegetation covers the hills, and the burdened clouds shower down abundant blessings."

The history of the forests of France would alone be ample to fill all the space at our command. The recent desolation wrought by floods is fresh in the memory of all. "By the destruction in France of a great extent of forests," writes Dr. Brown, "in order to replace them by cultivated fields, the temperature has become very irregular; heavy rains, storms, and dryness have each done their work upon the soil, and made crops every year more and more uncertain." In the Vosges, the destruction of forests has gone so far that agriculture has suffered, the soil has become arid, and inundations are frequent. In the department of the Gard, in 1837, "no rain fell for nine months." Nismes, named from the forests which once surrounded it, is now amid an arid waste. At Beziers, the Agricultural Society reported in 1797, that the forest which once sheltered the place having been destroyed, the loss of the olive crop was the consequence. The authorities of the Isere represented, in 1793, that the destruction of the forests had altered the temperature, augmented dryness, and seriously affected the crops. From Provence, from the valley of the Moselle, from that of the Haute Garonne, from the Herault, and from the Eastern Pyrenees, come complaints of the same nature. The regular rainfall has been diminished, the temperature has changed and become uncertain, and partial

and irregular storms have proved curses rather than blessings, wherever forests have been ruthlessly swept away.

So fully are these facts regarded as established in Switzerland, that in Social Science Congress at Berne, in 1865, the question was raised as to means of establishing a common legislation between countries watered by same rivers, in order to protect their respective interests, by the maintenanc the mountain forests, and the greatest possible attention is now paid to the ject by all the Cantonal Governments of Switzerland.

It is hardly necessary, after so much evidence as to the consequence that destruction of forests which is now so actively going on in many part he Old World as well as of the New, to follow Professor Laurent, of Nanc the desolation which has been brought on the former homes of teem human life in the East by the same cause. Babylon and Nineveh, The Memphis, and Carthage, now waste and even pestilential, were formerly very hives of human life. The remains of conduits, canals, cisterns, and p throughout Palestine, and especially through the now desert country east of Jordan, are such as to explain the accounts on record of the former popula of these regions. So thorough has been, not only the change of climate, the denudation of soil, caused by the cutting down the olives, palms, and o trees of Palestine during the Roman war, that it would be impossible to att any credit to the most venerable accounts of the former fertility, beauty, population of the Holy Land (its brooks and fountains gushing out of va and hills, being now replaced by bare and solid rock,) without the knowle that we have acquired of the fatal effect of the destruction of the timber. E as to that country of which it was said, 2,400 years ago, that "the famil Egypt have no rain," the United States Commissioner of Agriculture for 1 reports: "In Upper Egypt the rains, which eighty years ago were abund have ceased since the Arabs cut down the trees along the valley of the towards Lybia and Arabia. A contrary effect has been produced in L Egypt, from the extensive planting of the Pacha. In Alexandria and C where rain was formerly a rarity, it has, since that period, become more quent."

The ancient laws of the Monotheistic races prohibit the wanton destru of fruitful trees. The folk lore of the Aryan people placed groves and fo under the special care of the immortals. Casting aside all veneration for ditional restrictions as superstitions, intent only on a rapid result, like th the rustic who sought to hasten the acquisition of the golden egg, the hu race at the present moment, from the Wiltshire cornfields to the forests of Zealand, is emulously engaged in a not altogether abortive effort to rende face of the earth riverless, and to extend the desolation of the Sahara over tinent and island.

We venture to suggest that each of the three great pestilences which h now, for more than a quarter of a century, so heavily smitten three import sources of human food, drink, and clothing, may be distinctly traced to th

sistent neglect of those natural laws on which the science of forestry depends. The potato blight and famine, the varied and succeeding diseases or disasters of the vine, and the progressive extermination of the silkworm by the ravages of the pebrine, an insect epidemic unknown before 1842, each co-exist with a form of culture that is opposed to a very general law of vegetable physiology. Plants, no less than animals, have their natural terms of life. It is less easy to define the period, in the former case, as it is also more easy artificially to extend it. But it is another matter to pay no regard to the consideration.

The regular descent, or propagation, of vegetables by seed is a part of the order of nature. The greater part of the food of man being derived from annual plants, the ordinary routine of seed-time and harvest is aided by the care of the agriculturist. But in those plants of longer growth, in the culture of which great improvement on the wild stock has been superinduced, the production of seedlings very imperfectly keeps up the advantage gained by the cultivator. Hence the latter is induced to multiply the individual plant by buds, grafts, or slips. In this way a whole orchard, vineyard or potato field is filled with separated portions of the same original plant, each forming its own roots, and discharging its own vegetable functions, apart; but each partaking, not only of a common nature, but of a common age. That age, by this artificial method, is protracted far beyond the natural term of vegetable life. That the weakness, the inability to resist attack from disease or from animal and vegetable parasites, which accompany old age, are thus communicated to the entire stock of a district, seems to us to be undeniable. In the case of the apple, this effect of old age has become evident by the extinction of many varieties, once highly prized. Different varieties of pippins, for example, directly or indirectly grafted from the same stocks, were virtually of the same age, and thus not unnaturally disappeared about the same time. With the potato, and even with the vine, the constant replantation of portions of the tubers of the same plant, or of shoots and slips of the same valued stock, may have had, and is most likely to have had, an effect similar to that observed in the apple, although the display of the infirmity of age may differ in more or less ligneous plants. If we regard our potato fields as mainly devoted to the support of a few plants, of extreme age, subdivided to an enormous extent; if we regard the vineyards of the Continent as filled, in the same way, with the subdivisions of a very few aged individuals, we shall cease to wonder at the liability of the vegetables to suffer from either fungoid or insect parasites.

The remedy is probably more difficult and uncertain the longer it is deferred. But, unless the laws of vegetable physiology are extremely obscure, there is only one remedy, and one to which we must come at last. It is more than probable that the reverting to the order of nature, by raising a new set of individuals from seed, may be a tedious and disappointing process. The children of aged or of diseased parents are rarely without marks of hereditary infirmity. But whether from the wild stock, as in the first instance, or from seedlings from cultivated varieties, it can, we think, be only a question of time that both the potato and the vine must be renewed.

With reference to the silkworm, the case, although not identical, is simi
It has been remarked that the silkworm epidemic differs in some impor
respects from all previous epidemics. "It did not," says Mr. Alexander M
ray, in his report on "Products of Useful Insects," "come from the East.
first showed itself in France, in 1842, in the Herault and Poitou, and then
in a local and erratic manner; indeed there are reasons for thinking that it
have been brooding for twenty years previously in the valley of the Dur
and neighborhood of Cavaillon, whole establishments of silkworms (*magn*
having there at different times suddenly perished without apparent cau
other symptoms having shown themselves, which are now known to be the
he pebrine." The progress of the disease was not very great at first, b
855 and 1856 it increased so rapidly that M. Quatrefages reported to
nstitute that he could not find a single healthy caterpillar. From 1858 to
consumption of silk in this country declined from 10,021,766 lbs. to 5,27
or nearly one-half. In 1864 our importations from China fell from 7,000,
,000,000 lbs.

It is urged in the report we have quoted that the expectation entert
by M. de Quatrefages, that the pebrine, like better known epidemics,
gradually spend its force, has been thwarted by the constant importation o
eggs, *graines* as they are called, from uninfected sources, in China and ja
It is tolerably clear what would have been the result had no such im
been effected. It would have been the total destruction of the silkworm,
the silk industry, in France, and in other infected regions. But the a
drawn from the plague, the cholera, and similar human affections, is at a
unproved to exist with regard to the silkworm. By the introduction
new *graines* into a *magnanerie*, one main cause of the spread of the epi
avoided. No contagion, or personal infection, can exist in that case.
to conclude that the obvious precaution of cleansing and disinfecti
ments devoted to hatching and feeding has been neglected. We know
has not been, at least in some cases, the fact. We are thus driv
epidemic theory, to believe in the existence of some wide-spread i
larking in the air or the emanations of the soil, and appreciable in no
by its action on the silkworm.

Is it not more sensible, or at all events more practical, to inq
there is anything in the food, or mode of feeding of the entire
be noxious even to the most healthy individuals?

It is difficult to look at the bare, contorted, bleached forms of the
trees which, in many cases within our own knowledge, supply the
silkworms, without seeing that they evince no signs of healthy vegeta
is the cause far to seek. Year after year, with unsparing regularity,
been totally stripped of their leaves. The trees have not died; but
given evident tokens of distress. It is impossible but that their organizati
have been disastrously affected by the constant check put on the functio
leaves. What that function is we partly, if only partly, know. The

juice of the outraged tree must be overcharged with that oxygen which the leaf is constructed to eliminate. The new leaves have an accumulation of work forced upon them. Is there any wonder that their juices should be less suited to the nourishment of insect life?

Unless this view can be shown to be incorrect, it follows that the remedy for the pebrine, or for any of the twelve or fourteen well-marked distinct diseases to which the silkworm is subject, is to be sought in due care to supply to the animal a pure and healthy diet. How far the quality of the silk might be affected by the substitution of the leaves of any annual plants for those of the mulberry, is matter for experiment. But if it be established that it is this way alone which will yield the food on which silk such as we formerly had can be made, the question reduces itself into that of devoting a greater area to the production of the mulberry. If plants of from one to three or four years old were exclusively used, the existing trees being grubbed up for firewood, and replaced by new seedlings, we venture to predict that we should at once recover the old quality of our silk.

Into the special products of arboriculture, indeed, we must forbear now to enter. The subject is full of interest. Among the 3,000 species of wood of which specimens were shown at the Paris Exhibition in 1867 were to be found samples of the most varied beauty; of ivory smoothness and purity of color and texture, or streaked, pencilled, mottled, ocellated, and marked with every imaginable caprice. Arboreal products, apart from wood, are numerous. Such are the bark of the cork-oak in Portugal, and that of our own oak coppices and woods, stripped in spring for the use of the tanners. Such are the gums from Zanzibar, from Angola, from Senegal, and from Mogador; the resin from the forests of the Landes, the caoutchouc from the banks of the Amazon. The physiognomy of trees, the mode in which each well-grown tree tends to fill out the sketch given in the venation of the leaf; the effect produced on landscape by the social or solitary growth of trees; the wonderful glow of the flowers of some tropical species, as in that crimson-petalled and glossy-leaved tree that lines the banks of the Parana; the variety of form in the same species, according to locality, as in the olive, which, from the size of a currant-bush on the hills near Marseilles, rises to that of a lofty forest tree by the shores of the Ionian Sea; are subjects on which we have no space to dwell. Nor can we pause to speak of the dangers and foes of the forester; how broad spaces should be left as barriers against fire, while at the same time any rash opening cut in a forest may admit the winds which overthrow the trees, or the sun which strikes with fatal energy on their bark. Insect and other animal foes lie in wait for every symptom of weakness—the bark-beetle, the wood-beetle, the squirrel, the rabbit, the field-mouse, the wild hog, the deer. The insectivorous and carnivorous birds are the great allies of the forester, paying ample rent for the shelter afforded by the forest. Against drought, the great foe to agriculture, the forests can protect not only themselves but the neighboring country. Their only irresistible foe is man—chiefly seen in the guise of a squatter or of the lumber dealer.

Although British India is now enriched by the most brilliant triumph achieved by the skill of the forester, in the naturalization of the precious C cona, it is difficult to exaggerate, or even adequately to characterize, the neg of this important subject which prevails around us.* Here and there a sc tific man, like Dr. Hooker or Dr. Brandis, raises his voice. Here and there official is stimulated to activity by the occurrence of disasters which take dimensions of national disgrace. Here and there we meet with associations private efforts, in the direction of scientific arboriculture. But as a rule, woodland growth of the country and her colonies is regarded only from standpoint of a penny-wise economy. Education in forestry or arboricul no part of the *curriculum* of our colleges; not even excepting tha which the best education which the country affords is given to the cadets f whom our scientific corps, the physical administrators of India, are recrui we may say that a positive mischief is induced by doctrines now u is those of scientific agriculture. Lofty hedges, rambling coppice, spre rees that give a park-like character to the landscape, are regarded only a nany unprofitable occupants of sundry patches of ground on which corn m oe grown. They are, accordingly, being clean swept from many parts o. country. To ask the "improver" to think of scenery, of beauty, or of she would of course be idle. But the model farmer should be taught that in stroying the natural home of that winged police which a small percenta grain far underpays for their efficient service against the insect enemies of crops, he is guilty of an economic offence. In destroying the lines of sh that break the fury of the winds, he is committing an economic offence. by the ruthless zeal with which these erroneous demolitions are effected, h deteriorating the character of the climate, and diminishing the rainfall of country.

Nor are those who grasp the helm of public affairs less negligent in matter of forestry than either the peasant, the farmer or the schoolma When, after long neglect, the occasion was afforded for an intelligent efficient legislation on the subject of public health, the ideas of the frame the measure did not extend beyond the length of giving a few additional pe to the parish doctors, and a little more work to the scavenger. The ide climatic law; of the need of studying its principles; of the absolute depend

*The courage, skill, energy, and perseverance displayed by Mr. Clement R. Markham in his v dition to Bolivia, in 1860, to procure plants and seeds of the most valuable species of Chinchona, ever gentleman to the Victoria cross of Forestry. He was well supported by the Government in all point The miserable parsimony or carelessness that refused to place a steamer at his disposal nearly made expedition abortive. The intense heat of the Red Sea killed the greater number of the plants obtained at risk and cost But for Mr. Markham's precaution in leaving a few plants with Sir William Hooker at K the measures he took for obtaining seed at the proper season from places which he indicated, it is highly that the Chinchona, one of the most precious of all plants, would have been absolutely exterminated o days. We published in October, 1863 (Ed. Rev., vol. cxviii., p. 257), a full account of that most remarkable ment, and we are now happy to add that, ten years later, in 1873, 2,645,373 Chinchona plants were l growing in the Government plantations on the Nilghiri Hills alone; while numerous other plantations w ing. 91,773 lbs. of bark were supplied to the quinine manufactories on the plantations during 1873. The income from the plantations had risen to £16,500, with prospects of large increase in future years. The trees, with their glossy rich leaves and fragrant racemes, cover the slopes of the mountains which overhang W and line the hill-sides almost to the peak of Dodabetta. "Chinchona cultivation is now entirely out of t gory of experiments; and soon the grand object will be secured, namely, the provision of an abundant supply invaluable febrifuge at so cheap a rate as to be within the means of the population at large." *Vide* "Sta the Moral and Material Progress and Condition of India during the year 1872-3."

of public health on the thorough grasp of these principles; and of the function of the civil engineer as the rectifier of centuries of neglect, seems never to have penetrated the precincts of Whitehall. That a great system of rainfall, watershed, water-supply, irrigation, drainage, and outfall, finding its cradle in woodland heights, and its outlet in the sea, needed scientific study, has not been a consideration brought before Parliament. After passing a library of Acts of Parliament, it is for the first time in the present year, in a clause of the dropped Bill for the Prevention of the Pollution of Rivers intended to facilitate the formation of watershed districts, that we have found any evidence that a Minister of Public Health has sought to make himself acquainted with the simplest rudiments of the subject on which he has undertaken to legislate.

Wide as is the field of which we have here attempted the survey, its salient features are few and simple. At the commencement of the present century, from a fifth to a fourth part of the area of dry land on the globe was covered with a rich wealth of virgin or cultivated forest. From this breadth of more than seven millions of square geographical miles an unfailing crop, varying, according to latitude and to level, from four hundred to upwards of sixteen hundred loads of timber per mile may be annually obtained, in perpetuity, by careful culture. The footfall of man on newly discovered shores has been attended, but too often, by a wanton destruction of that vegetable clothing of the earth, on the extermination of which fertility ceases, and a garden becomes a desert. At the rate at which that destruction is, in some regions, even now proceeding, a century from the date of colonisation will suffice for the process of denudation. Within a quarter of that period man has effected, in many cases, such a deterioration of climate as to render some countries absolutely unproductive, and almost all newly settled countries less productive, than was formerly the case. The springs and sources of future wealth are tapped and wasted by this ravage of the forests. The destruction of their venerable shade seems to be the object of blind impulse wherever man finds a new territory open to his enterprise. What the firebrand of the settler effects in the virgin forests of the New World is wrought by the axe of the revolutionist amid the stately woodlands of the Old. It seems as if popular energy, when turned into a fresh channel, betrayed an instinctive hostility to the forest. Forming the shelter and the pride of ancient state, regal, ecclesiastical, or seigneurial, the patriarchs of the vegetable kingdom have reared the green tracery of their lofty vaults towards heaven, from which they have attracted a blessing that man would seek in vain without their aid. They have resembled castles and cathedrals reared by nature herself. As patient culture has tilled the fields that lay around their feet, the integrity of their beauty has been preserved only where ancient territorial rights have been maintained. The municipal spirit reduces the forests to a source of short-lived revenue; the anarchial spirit reduces them to ashes. With the downfall of ancient dignities the forests everywhere fall. With the growth of that selfish kind of industry that recognizes in every perch of ground merely an area for the manufacture of food, and that seeks from the hand of

nature nothing but the satisfaction of the appetites common to the brutes, natural fertility of a country becomes more and more exhausted. Scie raises a warning voice. Observation and induction show that our woodla stand between the dead and the living. The fall of the forest, which can more be replanted than any ancient institution of historic growth can be placed by the artificial product of legislation, involves the loss of the fertility well as of the beauty, of a country, and hastens the desolation of the earth.

—*Edinburg Rev*

LIONS AND LION HUNTING.

We know very little about lions, considering our centuries of observ and the abundant examples on which that observation has been exercised; he reason is that we have known the lion only in captivity, under very de tive circumstances. Even travelers and naturalists, perfectly aware of fact that he belongs to the feline race, describe him as if the broad dayli and not the stormy midnight, were his element; and because sometim traveler has found himself in daylight face to face with a half-sleepy lion mov from his couch on account of the flies in the sun, and because this lion in a stat beatific digestion (having the night before devoured an ox), does not smite traveler to the earth, the idea of his magnanimity and generosity have b circulated, or because in this state he generally declines combat, espe if fired at, the idea of his cowardice has also gained acceptance. Had n alists studied this majestic animal in the mountain gorges from twilight dawn, had they watched him coming to drink at the stream, or in the f when the moon has risen, or dashing among the tents when beef will not his epicurean taste eager for man's flesh,—in a word, had they watched hi Gerard has, rifle in hand, lonely, with the intense eagerness of a hunter w life depends upon his minutest observation being accurate, we should another conception of the lion from that to be derived by a study of bon inspection of menageries.

Let us first sketch the story of the lion's life, beginning with his marri which takes place toward the end of January. He has first to seek his but as the males are far more abundant than the females, who are often in infancy, it is not rare to find a young lady pestered by the addresses of or four gallants, who quarrel with the acerbity of jealous lovers. If them does not succeed in disabling or driving away the others, Madam, i tient and dissatisfied, leads them into the presence of an old lion, whose she has appreciated at a distance. The lovers fly at him with the temerity youth and exasperation. The old fellow receives them with calm assura breaks the neck of the first with his terrible jaws, smashes the leg of the sec

and tears out the eye of the third. No sooner is the day won, and the field clear, than the lion tosses his mane in the air as he roars, and then crouches by the side of the lady, who, as a reward for his courage, licks his wounds carressingly. When two adult lions are rivals, the encounter is more serious. An Arab perched in a tree one night, saw a lioness followed by a tawny lion with full-grown mane; she lay down at the foot of the tree, the lion stopped on his path and seemed to listen. The Arab then heard the distinct growling of a lion, which was instantly replied to by the lioness under the tree. This made her husband roar furiously. The distant lion was heard approaching, and as he came nearer the lioness roared louder, which seemed to agitate her husband, for he marched towards her as if to force her to be silent, and then sprang back to his old post, roaring defiance at his distant rival. This continued for about an hour, when a black lion made his appearance upon the plain. The lioness arose as if to go towards him. But her husband, guessing her intention, bounded towards his rival. The two crouched and sprang on each other, rolling on the grass in the embrace of death. Their bones cracked, their flesh was torn, their cries of rage and agony rent the air, and all this time the lioness crouched, and wagged her tail slowly in sign of satisfaction. When the combat ended, and both warriors were stretched on the plain, she rose, smelt them, satisfied herself that they were dead, and trotted off, quite regardless of the uncomplimentary epithet which the indignant Arab shouted after her. This, Gerard tells us, is an example of the conjugal fidelity of Milady; whereas the lion never quits his wife, unless forced, and is quite a pattern of conjugal attentions.

Our lion then is married, let us say. He is the slave of his wife. It is she who always takes precedence; when she stops he stops. On arriving at *douar* (the collection of tents—what we call a "village") for their supper, lies down while he leaps into the enclosure, and brings to her the booty. watches her while she eats, taking care that no one shall disturb her; and until her appetite is satisfied does he begin his meal. When she feels that is about to be a mother, *i. e.*, towards the end of December, they seek isolated ravine, and there, without the aid of chloroform or Dr. Locock presents her lord with one, two, and sometimes three puppies, generally male and one female. If the reader has ever seen and handled a puppy he will understand the idolatry of the mother and father. She never them for an instant, and he only quits them to bring home supper. When are three months old their weaning commences. The mother accustoms gradually to it by absenting herself for longer and longer periods, and them pieces of mutton, carefully skinned. The father, whose habitua is grave, becomes fatigued by the frivolous sports of his children, and sake of tranquillity removes his lodging to a distance, within reach, to render assistance if required. At the age of four or five months the follow their mother to the border of the forest, where the father brings their supper. At six months old they accompany father and mother

nocturnal expeditions. From eight to twelve months they learn to attack she
goats, and even bulls; but they are so awkward that they usually wound t
for one they kill; it is not till they are two years old that they can kill a ho
or a bull with one bite. While their education is thus in progress, they are
times more ruinous to the Arabs, since the family does not content itself w
killing the cattle required for its own consumption, but kills that the child
may learn how to kill. At three years old the children quit home and set
themselves, becoming fathers and mothers in their turn. Their places
by another brood. At eight years old the lion reaches maturity,
to thirty or forty. When adult he is a magnificent creature, very differ
size, aspect, and disposition from the lions to be seen in menageries,
gardens — animals taken from the mother's breast, bred like rabb
of the fresh mountain air and ample nourishment. As an indic
the size attained by lions in a state of nature, we may cite the fact n
by Gerard, that the strongest man in the cavalry regiment, to whic
was unable to carry the skin and head of the lion Gerard had k

It is quite clear, on comparing the works of Gerard and Gordon Cumm
hat the lion of Northern Africa is a far more formidable enemy than the
of Southern Africa. Not only does Cumming seem to have triumphed wit
but he had to combat lions who ran away from dogs, and gener
avoiding coming to blows with him. This is quite contrary to Gerard's ex
ience. The lion of Northern Africa is but too ready to attack; hungry
not, the sight of an enemy rouses his fury at once; and as to cowardice, Gera
narrative leaves no room for such a suspicion. Indeed the lion, so far
running away from the hunter, attacks a whole tribe of armed Arabs, and
scatters them to the winds. No Arab thinks of attacking a lion unless
ported by at least twenty muskets: and even then, if the lion is killed, it
until he has committed serious damage in their ranks. For a long while
suffer him to devastate their *douars*, and carry off their cattle in help
resignation. It is not until their losses have driven them to desperation,
they resolve on attacking him in his lair, and then they always choose the
time. Having ascertained his lair, and having decided in full conclave tha
attack is to be made, they assemble at the foot of the mountain, and in
of thirty or forty march towards the lair, shouting at the top of their
On hearing the noise, the lion, if young, at once quits his lair; the lioness
the same unless she have her infants with her. But, as he does not fly,
soon in sight, and a discharge of musketry brings him down upon them
thunderbolt. If the lion is adult he knows the meaning of this noise
wakes him, and he rises slowly, yawning and stretching his limbs, rubbing
sides against the trees, and shaking back his majestic mane. He listens;
the approaching cries cause him to sharpen his claws, with certain premo
growls. He then stalks slowly towards the first ledge of rock which comma
the country, and espying his enemies from this height, he crouches and aw
The Arab who first sees him cries, "There he is!" and deathlike still

succeeds. They pause to contemplate him, and look well to their arms, while the lion slowly licks his paws and mane, thus making his *toilette de combat*. After a long pause, an Arab advances in front of the group, and in a tone of defiance, shouts, "Thou knowest us not, then, that thus thou liest before us? Rise and fly; for we belong to such a tribe, and I am Abdallah!" The lion, who has before this eaten more than one warrior who apostrophised him in precisely the same terms, continues passing his enormous paws over his face to beautify himself, and makes no reply to the challenge, nor to the second challenge, nor to the epithets of "Jew!"—"Christian!"—"Infidel!" liberally bestowed on him, until the voices swell in a chorus, which makes him impatient. He then rises, lashes his sides with his tail, and marches straight towards the insulters. The timid are already in flight; the brave remain and wait his attack—muskets ready, hearts beating. He is beyond their reach, and walks leisurely towards them. They now begin to retreat slowly, in order, their faces turned to him, until they rejoin the horsemen waiting at the foot of the mountain, who immediately commence galloping about, brandishing their muskets and yatagans, and shouting defiance. The lion, on seeing the horsemen on the plain, pauses to reconnoitre. No cries or insults move him. Nothing but powder will do that. It is heard at last, and then he changes his leisure march for a charge which scatters the little army. No one is ashamed of flying now; each tries to secure a favorable position from which to fire as the lion passes. The horsemen then advance. If, as is usual, the lion has clutched one of the retreating troop, it is only necessary for a horseman to approach within reasonable distance and discharge his gun, the lion at once quits his victim to charge his assailant. After awhile, the lion, wounded and tired, crouches like a cat and awaits his end. This is a terrible moment. He is fired at, and receives all their balls without moving; but should a horse gallop near enough to be reached in two or three bounds, either the rider or the horse is doomed, for the lion is upon him in an instant, and never quits his hold. It will astonish European hunters to hear that thirty balls, at a distance of twenty paces, are not always enough to kill the lion; it is only when the heart or brain is touched that death is certain; and the nearer he is to death the more dangerous he is. During the fight, but before he is wounded, if he clutches a man, he is satisfied with knocking him down; and the man, probably protected by his burnous, gets off with a mere flesh wound from the terrible talons. But after the lion has been wounded, he tears his victim, mangles him in his jaws, till he sees other men upon whom to spring; and when mortally wounded his rage is something awful. He crushes the victim under him, and crouches over him, as if rejoicing in his agony. While his talons slowly tear the flesh of the unhappy wretch, his flaming eyes are fixed on the eyes of his victim, who fascinated by them is unable to cry for help, or even to groan. From time to time the lion passes his large rough tongue over the face of his enemy, curls his lip, and shows all his teeth. Meanwhile the relatives of the unhappy man appeal to the most courageous of the troop, and they advance, guns cocked, towards the lion, who sees them

coming, but never moves. Fearing lest their balls should miss the lion and the man, they are forced to approach so close that they can place the muske the ear of the lion. This is a critical moment. If the lion has any force him, he kills the man lying beneath him, and bounds on the one who has c to the rescue; and as he lies motionless on the body of his victim, it is im sible to know whether he will bound or not. In case his strength is too m wasted, the lion crushes the head of the man beneath him the moment he the musket approach his ear, and then closing his eyes awaits death.

Such is the lion of Northern Africa, and the terror he inspires in the in Arabs who know his power is intelligible. Before quitting our descri notices, we must call upon Gerard for an account of the lion's roar, as he heard it while awaiting in a hiding-place the approach of the king of be After waiting for an hour, the first grumblings reached his ear, as if the were talking to himself, and these grew louder and louder, till the very roo the hiding-place trembles at the sound. The roarings are not very frequ sometimes a quarter of an hour or more elapses between each. They b with a sort of sigh, deep and guttural, yet so prolonged that it must have no effort; this sigh is succeeded by a silence of a few seconds, and then co a growl from the chest, which seems to issue through closed lips and swo cheeks. This growl, beginning in a very base note, gradually rises higher louder, till the roar bursts forth in all its grandeur and finishes as it commen After five or six roars, he finishes with the same number of low, hoarse c which seem as if he was trying to expel something sticking in his throat, last being very prolonged. Nothing in Gerard's remembrance presente fitting point of comparison with this terrible roar of the lion. The bellow of a furious bull is no more like it than a pistol-shot is like the sound c thirty-two pounder. Imagine what terror such a roar would inspire, hear the lonely mountain passes under the silent stars. On this occasion the roared for two hours without quitting his place, and then descended into valley to drink; a long silence followed, and then he began again more vi ously than ever. Soon after, Gerard saw the fires blazing in the distance, heard the men, women, and dogs yelling as if possessed with devils; for instant a roar covered all this tumult like a thunder-clap; and then the l seemed to continue his route quite tranquilly, not in the least disturbed by this noise, which only seemed like triumphant music accompanying the pow ful monarch on his march. He probably knew the terror his presence inspir at any rate he knew no terror at the presence of Arabs.

We have no space to tell Gerard's own story here. The lions are subject, and to them must be given all our attention.

Gerard describes at great length the death of his first lion; but altho he learned several useful details by which he afterwards profited, the campa was not one which can be abridged here with interest. His second lion nearly the victor. He had tied up the dogs in the tents in order to prese silence. Saadi-bou-Nar, his companion, slept behind him on the ground, wl

he, rifle in hand, awaited the appearance of his enemy. Suddenly the sky, which had been brilliant, was overclouded; the moon disappeared; the thunder began to mutter in the distance, like a distant lion; large drops of rain falling on the Arab, awakened him, and made him urge Gerard to retire within the tents. At this moment the Arabs shouted, "Be on your guard; the lion will come when the storm is at its height." Protecting his rifle with the burnous, Gerard waited, smiling to observe the heroic resignation with which Saadi-bou-Nar draped himself in his burnous. The rain, like all storm-rains, rapidly subsided. The sky was once more lighted by the brilliant moonbeams occasionally piercing through interspaces of cloud; at the horizon a few flashes of lightning were seen. Gerard, grateful for this fitful light, peered anxiously into space, and in one of the sudden flashes, there stood the lion, motionless, only a few paces from the enclosure of the *douar*. Accustomed to find fires lighted, dogs howling in terror, women frantic, and men throwing lighted brands at his head, the lion was perhaps meditating on the meaning of this silence and calm. Turning carefully, so as to take deliberate aim without the lion perceiving him, Gerard felt his heart beat as the last cloud passed over the moon. He was seated with the left elbow on his knee, the rifle at his shoulder, looking alternately at the lion, which presented only a confused mass to his eye, and the cloud which traveled slowly over the moon. At last his heart leapt — the moon shone in all her splendor. Never was sunlight more prized. There stood the lion, motionless as before; a magnificent creature, superbly majestic, with his head aloft, his mane tossed by the wind, and falling to the knee. It was a black lion of the grandest species. His side was turned towards his enemy. Aiming just underneath the shoulder, Gerard fired, and at the same time that the explosion was re-echoed by the mountains, rose the roar of rage and pain, and through the smoke the lion bounded on his assailant. It was an awful moment. The lion was within three paces; there was no time to aim; the second barrel was fired at hazard, and struck him in the breast; he rolled expiring at the hunter's feet. "At first," says Gerard, "I could not believe that the animal I had just seen bounding upon me in fury, and rending the air with his cries, was that monstrous inert mass lying at my feet On looking for my balls, I found the first, which had not been mortal, placed exactly where I had aimed it; and the second, fired almost at random, had been the one which proved fatal. From this moment I learned that it is not sufficient to aim accurately to kill a lion; and I began to see that lion hunting was far more serious than I had imagined."

The terror inspired by the lion is vividly depicted in the narrative of events succeeding this encounter. Although the Arabs heard the firing they would not approach, lest the lion should still be living; for more than half an hour they remained within their tents, after which three of the bravest came out of the enclosure, bringing the jug of water Gerard had demanded: The leader came cautiously, looking round him every moment, his gun ready to fire; the second bearing the water came after, holding by the burnous of the leader, and pausing when he paused; finally, the third held in one hand the the burnous of

the second, and brandished a yatagan with formidable vigor. In this order came up to the lion; on seeing him they halted, and would not approac Saadi-bou-Nar struck his corpse with his hand to reassure them. And were men who in battle would fight like lions! Five minutes afterwards women, and children rushed out to see their vanquished foe, whom they trophised in eloquent insults. As the morning broke, hundreds of Arabs from all sides; but even in the presence of their dead enemy their terro not quite allayed; they kept within ten paces of his corpse, the women stan behind, timid and curious.

Gerard soon found that bullets were but an uncertain resource again animal whose frontal bone sufficed to flatten one fired at no greater dist than five paces, and who, when mortally wounded, had still strength and fer enough to dispatch half a dozen armed men. He, therefore, exchanged hi for ingots of iron, and even with these he ran terrible risk, as we see his first employment of them. At midnight, under the light of a full moo met a young lion, a mere puppy of two years old, who, on seeing him, lay across the path and did not move, even when Gerard was within fifteen p Believing this to be the animal's tactics, he thought better not to adv nearer; kneeling on the ground, he fired, aiming just beneath the shou How it happened he knew not, so sudden was the onslought; but befo could see anything he was knocked down, and his hand touched the leg o animal standing over him. "Luckily for me I wore my thick turban, whic tore with his teeth: slipping from it and leaving him my burnous, I blev the brains of this foolish youngster while he was spending his wrath upo clothes. My first ingot had passed right *through* his body, below the shou the second entering at his left ear came out at the right." Europeans im it a very simple thing to vanquish the lion; "you have only to be a good and to be perfectly cool." To be a good shot is not rare; but when you to meet such an antagonist, to await him, perhaps not to see him until about to attack, and then to know that your first ball, however well aimed only wound him, the "coolness" so lightly spoken of will be a very rare qu However adroit your first aim, you have little time for your second; the shot hits him while he is motionless; the second must be fired as he le upon you. Gerard soon learnt this, and he says with *naivete*, perfectly Fr that he always commenced the struggle with mingled doubt and confid *doubt* in the effect of his shots, *confidence* in the "protection divine qu'ac a sa creature l'Etre supreme"—as if the poor lion were not equally "sa ture!" That, however, is a thought never entering the minds of the hunt Arab. We were amused at the lamentations and imprecations of a discon woman, whose lamb had been eaten by a lion; she spoke with bitterness o "heartless wretch" who had eaten a lamb, which she herself would have had not the lion anticipated her!

Such being the terror and hatred inspired by the lion, we can under the frantic demonstrations of joy over his corpse. They triumph over

dead foe, insult him, call him "assassin," "thief," "son of a Jew," "Christian," and "pagan;" pluck his beard in scorn, and kick him contemptuously. It is a relief to their hatred,—a reaction of terror. In reading this we are naturally reminded of that scene in Homer, where the Greeks crowd round the dead body of Hector, marveling at his great stature, and each inflicting a wound on the terrible corpse. And we think translators and commentators fall into a blunder when they translate and understand the phrase applied to Achilles meditating the vengeance of dragging Hector round the walls, as if Homer meant to stigmatize Achilles.

Very picturesque is the scene of triumph. The fires are lighted in the forest; moving amidst the snow and trees are groups of men and women, looking by the firelight like phantoms, in their white burnouses, as they distribute the pieces of lion-flesh roasted on a brasier big enough for an elephant. The women chatter on their universal theme; the men talk of powder, bloodshed, and lions; Abdallah, the singer, yells improvised couplets, while a flute-player charms the savage ear. They have insulted the lion, and now they eat him!

If the reader has ever had the pleasure of playing with a puppy lion he will comprehend the fascination of such a favorite in the Arab tents. The delight created by such a playfellow is not simply the delight which any fat joyous puppy, gracefully ungraceful, and sublimely careless, will excite in all well-constituted minds; it is that, and *with* it the feeling of all the ferocity, power, and grandeur which lie nascent in this innocent child. This feeling will of course be intensified by the terror felt for the grown lion; and as that terror is very great among the Arabs, we can imagine the interest Gerard excited by bringing into their tents a lioness of about a month old, no larger than an Angora cat, and a lion about a third larger. The young lady had all the timidity of her sex, slunk away from every one, and answered caresses with blows of her little paws; her brother, whom they christened Hubert, had more manly *aplomb*. He was quiet, looking with some astonishment at all that passed, but without any savageness. The women idolized him, and were never tired of caressing him. A goat was brought to be his nurse. At first he took no notice of her, but no sooner had a few drops of milk moistened his lips than he fastened upon her with leonine ardor. The goat had of course to be held down—she by no means fancied her illustrious foster-son! But although the lioness had seen her brother take his meals in this way, she could not be seduced to follow his example. She was never quiet or happy except when in concealment. Hubert passed the night under Gerard's burnous as tranquilly as if with his mother; and indeed throughout his career Hubert showed a sociability which speaks well of him. His sister died the death of many children—*teething* was fatal to her! Nay, Gerard assures us that teething is a very critical affair with young lionesses, and often carries them off, there being no kindly surgeon to lance their little gums. Hubert was taken to the camp, where of course he became the idol of the regiment, always present at parade, and gambolling with the men during the idle hours. As he grew up his ex-

ploits became somewhat questionable. He had early strangled his nurse, goat. He then showed a propensity for sheep, donkeys, and Bedouins, w made it necessary for him to be chained up, and, finally, having killed a hc and dangerously wounded two men (owing to some difference of sentime he was caged. Gerard of course continued to pet him. Every night he ope the cage. Hubert sprang out joyously, and began playing with him at hide-a seek; embracing him with an ardour which was more affectionate than ag able. "One night, in high spirits, he embraced me so fervently that I sh have been strangled had they not beat him away with their sabre-sheaths. T was the last time I cared to play hide-and-seek with him. But I must do the justice to say, that in all our struggles he scrupulously avoided using t or talons; he was the same to all whom he liked, and to whom he was re very affectionate and gentle." Hubert was sent to Paris, and placed in *Jardin des Plantes*, where some time afterwards Gerard went to see him. was lying half asleep, gazing with indifference on all the visitors, when s denly he raised his head, his eyes dilated, a nervous twitching of the muscl his face and agitation of his tail showed that the sight of the well-known unif had roused him. He recognized the uniform, but had not yet identifiec old master. His eyes eagerly interrogated this vaguely remembered fc Gerard approached, and, unable to resist his emotion, thrust his hand into cage. It was a touching moment which followed: without taking his from Gerard, he applied his nose to the outstretched hand, and bega breathe deeply; with every breath his eye became more affectionate, and w Gerard said to him, "Well, Hubert, my old soldier!" he made a terrible bo against the bars of his prison, which trembled beneath his weight. "My frie alarmed, sprang back, and called on me to do the same. Noble beast! t art terrible, even in thy love! He stood up, pressed against the bars, stri to break through the obstacle which separated us. He was magnificent as stood there roaring with joy and rage. His rough tongue licked with joy hand which I abandoned to him, while with his enormous paws he trie draw me gently to him. No sooner did any one approach the cage than flew out in frightful expressions of anger, which changed into calmness caresses on their retreating. It is impossible for me to describe how pai our parting was that day. Twenty times I was forced to return to reassure that he would see me again, and each time that I moved out of sight he m the place tremble with his bounds and cries." Poor Hubert! this visit, the long *tete-a-tetes* of subsequent visits, made captivity a little less painfu him, but the effect seemed to be injurious on the whole. He drooped, and keepers attributed it to these visits, which perhaps made him languish for camp and his old days of liberty. He died, leaving Gerard firmly resolve kill as many lions as he could, but to capture no more: death in the forest a rifle, being infinitely preferable to a pulmonary disease bred in prison.

Has the lion a power of fascination? The Arabs all declare he has, that both men and beasts are forced to follow him when once he exercises

power over them. The royal aspect and the piercing splendor of his tawny eye, together with all those associations of terror which his presence calls up, may suffice to paralyse and fascinate an unhappy victim, although Gerard says, for his part, he never felt the slightest inclination to follow and exclaim—

"Oui, de ta suite, o roi, de ta suite, j'en suis."

For our own part, we can believe in any amount of fascination. We were once embraced by an affectionate young lioness, who put her paws lovingly round our neck, and would have kissed our cheek, had not that symptom of a boldness more than maidenly been at once by us virtually repressed. The fascination of this tawny maiden, by whose embrace we were haunted for a fortnight, was equalled by the humiliation we felt on another occasion in the presence of the forest king. All visitors to the Zoological know and admire the noble lion who occupies the last den: and most visitors have seen his wrath when the keeper approaches his den before the bone he is gnawing is perfectly clean. The sight of his wrath and the sound of his growls greatly interested us, and the keeper not being at hand to excite them, we one day got over the railing opposite his den, and began dancing the *hishing* before him, in a wild and, as we imagined, formidable manner. Instead of flashing out in wrath and thunder, the lion turned his eye upon us, and in utter contempt continued licking his leg of beef, perfectly untroubled by our *hishing*, probably asking himself the meaning of those incomprehensible gesticulations. We felt small. He evidently did not thing us worth even a growl; and we were forced to get back over the railing, utterly discomfited by the quiet dignity of his majesty.

However, on this subject of fascination, let us hear the story which Gerard heard from the Arabs. Some years ago, Seghir, the hero of this adventure, was denied the hand of his mistress from no worse crime than *impecuniosity*, which has cut many a true love-knot, and he thought it simpler to elope with his beloved. He did so; but his path was dangerous, and he armed himself to the teeth. In this path he suddenly espied a lion walking straight towards them. The girl shrieked so fearfully that she was heard in the tents, and several men rushed out to the rescue. When they arrived, they saw the lion slowly walking in front of Seghir, on whom his eyes were constantly fixed, and leading him thus towards the forest. The young girl in vain tried to make her lover cease to follow the lion, in vain tried to separate herself from him. He held her tight and drew her with him, saying, "Come, O my beloved, our Seigneur commands us; come." "Why don't you use your arms," she cried. "Arms? I have none," replied the fascinated victim. "Seigneur, believe her not; she lies; if I am armed, I will follow you wherever you will." At this moment eight or ten Arabs came up and fired. As the lion did not fall, they took to their heels. With one bound the lion crushed Seghir to the earth, and taking his head within his enormous jaws, crunched it; after which he lay down by the side of the young girl, placing his paws upon her knees. The Arabs now, finding they were not pursued, took courage, reloaded, and returned. At the

moment their guns were pointed, he sprang into the midst of them, seizing with his jaws, and two with his claws, dragging them thus together, so that three formed as it were, but one mass of flesh; he pressed them under him, mangled them as he had mangled Seghir. Those who had escaped ran bac their tents to relate what they had witnessed. None dared return; the carried off the girl into the forest. On the morrow the bodies of the four were found. That of the girl was looked for, but they only found her hair, feet, and her clothes. Her ravisher had eaten the rest.

We have said that Gerard declares never to have felt the fascinating pe of the lion in his own person, but in one of his adventures he testifies to fact as regards a bull, whom the lion caused to walk slowly before him to spot where it should please his majesty to devour him. The lion, on se Gerard approach, stopped; the bull, ten paces in advance, stopped at the s time. Who will explain this? We dare not attempt it; the more so as limits are already touched.

The following account by Mr. Cumming, who spent some months in h ing in Africa, gives a fearful picture of their banquets. It will be unders that the narrator had shot three rhinoceroses near a fountain, and soon twilight had died away, he came down to the water to watch for lions. W him was his Hottentot attendant, Kleinboy.

"On reaching the water I looked toward the carcass of the rhinoceros, to my astonishment I beheld the ground alive with large creatures, as thou troop of zebras were approaching the water to drink. Kleinboy remarke me that a troop of zebras were standing on the height. I answered "Yes;" I knew very well that zebras would not be capering around the carcass rhinoceros. I quickly arranged my blankets, pillow, and guns in the hole, then lay down to feast my eyes upon the interesting sight before me. It bright moonlight, as clear as I need wish. There were six large lions, a twelve or fifteen hyenas, and from twenty to thirty jackals, feasting on around the carcasses of the three rhinoceroses. The lions feasted peacably, the hyenas and jackals fought over every mouthful, and chased one ano round and round the carcasses, growling, laughing, screeching, chattering, howling, without any intermission. The hyenas did not seem afraid of lyons, although they always gave way before them; for I always observed they followed them in the most disrespectful manner, and stood laughing, or two on either side, when any lions came after their comrades to exa pieces of skin or bones which they were dragging away."

The following sketch of one of these lion "man-eaters," as they are ca (for having once tasted human flesh they will eat nothing else if it can be tained,) is by the same adventurous person. He and his party had, unkn to themselves, pitched their camp in the proximity of a lion of this descript All had retired to rest, when suddenly, says the narrator, the appalling murderous voice of an angry, blood-thirsty lion burst upon my ears with few yards of us, followed by the shrieking of the Hottentots. Again and a

the murderous roar of attack was repeated. We heard John and Ruyter shriek, "The lion! the lion!" Still for a few moments we thought he was but chasing one of the dogs round the camp; but the next instant John Stofulus rushed into the midst of us, almost speechless with fear and terror, his eyes bursting from their sockets, and shrieked out, "The lion! the lion! he has got Hendrick! He dragged him away from the fire beside me. I struck him with the burning brands upon the head, but he would not let go his hold. Hendrick is dead! O God! Hendrick is dead. Let us take fire and seek him." The rest of the people rushed about, shrieking and yelling as if they were mad. I was at once angry with them for their folly, and told them that if they did not stand still and keep quiet the lion would have another of us, and that very likely there was a troop of them. I ordered the dogs, which were nearly all fast, to be let loose, and the fire to be increased as much as possible. I then shouted Hendrick's name, but all was still. I told my men that Hendrick was dead, and that a whole regiment of soldiers could not now help him, and hunting my dogs forward I had everything brought into my cattle kraal, when we lighted our fire and closed the entrance as well as we could. It appears that when the unfortunate man Hendrick rose to drive in the ox, the lion had watched him to his fireside, and he had scarcely lain down when the brute sprang upon him and Ruyter—for both lay under one blanket—with his appalling roar; and roaring as he lay, grappled him with his fearful claws, and kept biting him on the breast and shoulder, all the while feeling for his neck; having got hold of which, he at once dragged him away backward round the bush into the dense shade. As the lion lay on the unfortunate man, snarling and biting him, he faintly cried, "Help me! O God! Men, help me!" After which the fearful beast got hold of his neck, and then all was still, except that his comrades heard the bones of his neck cracking between the teeth of the lion. It is some satisfaction to know that Mr. Cummings afterwards killed the lion.

Mr. Livingstone gives the following account of his narrow escape from a sudden and terrible death from a lion: The village of Mabotsa was much troubled by lions, which leaped into the cattle-pens by night, and destroyed the cows. They even attacked the herds in open day. This was so unusual an occurrence that the people believed that they were bewitched—"given" as they said, "into the power of the lions by a neighboring tribe." They went once to attack the animals, but being rather a cowardly people compared to Bechuanas in general on such occasions, they returned without killing any. It is well known that if one of a troop of lions is killed, the others take the hint and leave that part of the country. So the next time the herds were attacked, I went with the people, in order to encourage them to rid themselves of the annoyance, by destroying one of the marauders. We found the lions on a small hill, about a quarter of a mile in length, and covered with trees. A circle of men was formed around it, and they gradually closed up, ascending pretty near to each other. Being down below on the plain with a native school-master named Mebalwe, a most excellent man, I saw one of the lions sitting on a piece

of rock, within the now closed circle of men. Mebalwe fired at him befo could, and the ball struck the rock on which the animal was sitting. He bi the spot struck, as a dog does at a stick or stone thrown at him, then leaj away, broke through the opening circle and escaped unhurt. The men v afraid to attack him, perhaps on account of their belief in witchcraft. W the circle was re-formed, we saw two other lions in it, but we were afraid to lest we should strike the men, and they allowed the beasts to burst thro also. If the natives had acted according to the custom of the country, t would have speared the lions in their attempt to get out. Seeing we could get them to kill one of the lions, we bent our footsteps toward the village. going around the end of the hill, however, I saw one of the beasts sitting piece of rock as before, but this time he had a little bush in front. B about thirty yards off I took a good aim at his body through the bush, and both barrels into it. The men called out, "He is shot!" "He is shot!" Ot cried, "He is shot by another man, too; let us go to him." I did not see one else shoot at him, but I saw the lion's tail erected in anger behind the b and turning to the people said, "Stop a little till I load again." When in act of ramming down the bullets, I heard a shout. Starting and looking round, I saw the lion just in the act of springing upon me. I was upon a l height; he caught my shoulder as he sprang, and we both came to the gro below together; growling horribly close to my ear, he shook me as a te dog does a rat. The shock produced a stupor similar to that which seems t felt by a mouse after the first shake of the cat. It caused a sort of dreamin in which there was no sense of pain nor feeling of terror, though quite c scious of all that was happening. It was like what patients partially under influence of chloroform describe, who see all the operation but feel no knife. This singular condition was not the result of any mental process. shake annihilated fear, and allowed no sense of horror in looking round at beast. This peculiar state is probably produced in all animals killed by carnivora; and if so, is a merciful provision by our benevolent Creator for sening the pain of death. Turning round to relieve myself of the weigh he had one paw on the back of my head, I saw his eye directed to Me who was trying to shoot him at a distance of ten or fifteen yards. His g flint one, missed fire in both barrels. The lion immediately left me, and att ing Mebalwe, bit his thigh. Another man, whose life I had saved before, he had been tossed by a buffalo, attempted to spear the lion while he was b Mebalwe. He left Mebalwe and caught the man by the shoulder, but a moment the bullets he had received took effect, and he fell down dead. whole was the work of a few moments, and must have been the paroxysm dying rage.

The last three anecdotes are taken from "Goodrich's Natural History.'

— *Westminster Re*

S. FEATHERSTONE,

ARCHITECT *AND* *BUILDER.*

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VOL I. 1876 NO. 5.

FEBRUARY.

THE

A MAGAZINE DEVOTED TO

The Natural Sciences.

E. H. FITCH, Editor and Proprietor.

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The columns of the Scientific Monthly will be freely open for all well written articles on scientific subjects, and the candid setting forth of opinions and views on Natural Science.

Any papers sent to the editor will be carefully preserved, and returned to the contributor if desired.

The Secretaries of Scientific Societies are respectfully solicited to forward to the Editor, as soon after the meetings of their respective Associations as convenient, all reports of the proceedings and synopsis of essays and addresses read before them.

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FRENCH.

NATURAL SIZE.

The Scientific Monthly

DEVOTED TO THE NATURAL SCIENCES.

VOL. I. FEBRUARY, 1876. No

WANDERING ALBATROSS.

(*Diomedea Exulans.*)

Perhaps, if you have ever crossed the ocean, or been for any length of at sea, you may have observed, when two or three days out of sight of la large bird, with ample, widely-extended, wings, slowly winnowing its way the broad waste of waters; now ascending, far above, into the clouds, descending towards the surface. This is the Wandering Albatross.

The habitat of this species is confined within no particular limits. wide ocean is its range, and this it never leaves except for the purpose breeding, when it generally resorts to inaccessible rocky islands. The power flight of this bird are unexcelled. Sweeping continually over the waves wander over the sea and circle round the globe; their domain is the sea territory the wide world. By one tie only are they bound to the land, and is, as before mentioned, the affection for their offspring. Although in or moderate weather it sometimes alights upon the surface of the water, it is most constantly upon the wing, and is equally at its ease when passing over surface of a calm sea as when flying with meteor-like swiftness in the most terrible tempest, dashing with the greatest facility into the teeth of roaring wind, and above the tempest-tossed waves.

Like most species of the albatross, this bird is nocturnal as well as di in its habits, and takes little repose; indeed, it appears to be constantly on wing, skimming over the surface of the ocean for molluscs, medusæ, and marine animals that constitute its prey. When seizing an object floating the water they gradually descend with expanded or upraised wings, or they alight and float like a duck while devouring their food. When about to they run some distance upon the water, flapping their broadly-extended w several times before they mount into the air, when they begin again their solitary flight. This method of arising is necessary because the great length their wings prevents their mounting from a level surface with ease.

It is pleasing to observe the movements of this elegant bird sailing in the air with graceful easy motion. It appears to float about with no effort of its own, but seems as if propelled by an invisible power, for there is rarely any movement of the wings after the first few frequent impulses given as it arises into the air at the commencement of its flight. It rises, falls, and sweeps about in broad and widely-extended circles, without any apparent muscular exertion of its own. It is on account of the very little muscular action used by this bird when flying that it is enabled to sustain its flight for such surprisingly long periods of time without intermission. The Wandering Albatross breeds, in November and December, upon rocky islands in the south Pacific Ocean. The nest is about eighteen inches high, and six feet in circumference at the base, while the opening at the top is about twenty-seven inches in diameter. It consists of a mound of earth mixed with grass and leaves. It is built on the grass-covered declivities of hills, above thickets of woods. The eggs are pure white, and about nineteen ounces in weight. If approached while nesting it resolutely defends its possessions; and if driven off slowly moves away for a short distance, but does not take flight.

The natural home of this superb bird is the ocean. Here it wanders at will over the boundless waste of waters, and in the literal meaning of the words, extends its flight quite around the globe. Although this is the case in many instances, yet it is more frequent between 30° and 60° south latitude; yet they are often seen in the Pacific as far north as Kamschatka and Behring's Strait. Occasionally specimens have been seen off the coast of England and other parts of Europe. Sailors have many superstitious notions in regard to this bird, and it often enlivens many weary hours while far out at sea by relieving the monotony of the boundless waste of waters with no other living object visible, in its graceful motions and elegant flight, and its frantic and voracious efforts to secure whatever is thrown overboard; indeed it is sometimes caught by means of a baited hook, trailed overboard, which it seizes in its mouth.

The poet says of its flight—

"Safe in the storm, unhurt by wave or wind,
Or through the fearful tempest doest thou soar,
The fleetest vessel leaving far behind,
Unchecked amidst the elemental roar.

Alas! how sure the hand that guides thy wing,
How safe the rudder, instinct, shapes thy course;
Ah! how unlike things made by hands of clay,
Thy piercing eyes, thy pinions matchless force."

The voracity of this bird is very great. It has been seen to swallow entire a salmon of five pounds weight. They do not hesitate to devour any animal substance. They do not dive, but swim buoyantly.

The Wandering Albatross is forty-six inches long and fourteen feet across the wings; when adult the entire plumage is pure white, except the wings, which are black; the eye is brown; the bill is reddish white, its tip yellowish white; legs and feet yellowish white; weight, about twenty-eight pounds; feet with only three toes, all fully webbed; legs short, tibia naked for a short dis-

tance above the knee; tail short, rounded, consisting of twelve feathers; w very long, first primary longest; secondaries short, scarcely projecting bey the wing coverts, making the wing long and narrow. The bill is strong, culmen or top ridge concave, or slightly bowed inwards in the middle, the strongly hooked, cutting edges incurved, nostrils in short horny tubes; on of the bill from these a deep groove extends to the hooked tip; naked ey green. A specimen shot near the Cape of Good Hope was 17½ feet in ex of wings, but the average size is as here given. The wings extend one beyond the short broad and rounded tail. The tail is contained three time the wing, the middle toe is longer than the tarsus, inside toe equal to the mi toe, outside toe shorter than the middle toe, but longer than the tarsus.

DETAILED MEASUREMENTS.

Bill on top ridge, 7 inches; lower mandible tip to feathers on its side, inches.

Wing carpal-joint to end primaries, 25 inches.

Tail, 8 1-2 inches; its graduation 1 inch.

Tarsus, 4 inches; bare portion of tibia 2 inches long.

Middle toe, 6 inches; claw, 7-8 inch.

Inside toe, 6 inches; claw, 5-8 inch.

Outside toe, 5 inches; claw, 5-8 inch.

Outline of frontal feathers on top of bill concave, the concave side teriorly; outline of feathers on side of upper mandible, pointed.

The tail reaches to the middle of the middle toe when the legs are stretched.

The outline of the lower edge of the lower mandible is straight to the then slightly convex to the tip, occasioned by a ridge that starts from the ante angle of the rami of the lower jaw, and rising as it proceeds anteriorly to middle length, then descends to the tip of the bill; this ridge is rounded o sides; the tip of the lower mandible is truncated, its sides smooth and con eyes small, half an inch in diameter.

RATS IN THE SOMERSETSHIRE FLOOD.—During the recent great floods, laid under water a vast extent of land in Somersetshire, England, the rats v driven from their haunts in great numbers. Some of them found refuge in trees, and others took possession of deserted houses. One instance is recor where a labourer, having occasion to return to his cottage to rescue some perty left behind in his hasty retreat, moored his boat to the chamber-winc and was about to enter the room when he found it filled with a swarm of which were so ravenous with hunger that they were like a fierce pack of wol They attacked the man with such savage ferocity as to compel him to be hasty retreat to save himself from being torn to pieces and devoured.

THE OCEAN—ITS ORIGIN AND DESTINY.

BY J. MANFORD KERR.

THE ORIGIN OF THE OCEAN.

Of all the subjects that ever engaged the attention of man, that which involves the past history, the present aspect, and the future prospect of matter is one of the most curious, interesting, and instructive.

When we look out upon the universe, and down into the depths of our own souls, and contemplate with complacency the multifarious material and immaterial manifestations, we receive with ecstatic delight the irrefragable fact that there is an all-comprehending and all-potent Being, who is the Author and Preserver of all things.

In dealing with materiality, we commence with the present and trace retrospectively, and without difficulty, the history of telluric things through the various stages of progress in all the ages—the Human, the Mammalian, the Reptilian, the Carbonifurous, the Devonian, the Silurian—to the Prozoic. Here there is more difficulty, doubt, and uncertainty. The progress of science, however, warrants the diversion of this age into the following stages, to-wit: crusted-spherical, molten-spherical, zonular, and chaotic. This leads us back to a time when the whole material universe was diffused throughout space as far as the utmost line that bounds imagination's flight; and this is the *ultima thule* of our investigations. There is no satisfactory conjectural or hypothetical explanation of that something that lies beyond. It *is*, and is eternal. This is all we do or can know. Neither science, *quasi*-science, nor nescience can lift the shrouding veil and disclose that which lies within the inscrutable gloom. If any illumination or disclosure can be afforded, it must be sought in prescience; all explanations from any other source are illusory and inadequate.

The first accident of matter of which we do or can know, is the unstable proemial which obtained at the ushering in of the Chaotic stage of the Prozoic age. Simultaneously with the inauguration of this molecular-chaotic commotion, was a flash of light throughout the universe, announcing the work begun, and by its irradiance illuminating the ebon concave of primal, chaotic nature.

Since light and heat are simply different manifestations of the same great force, instead of two distinct forces mutually dependent, with this dissemination of light there must have been a corresponding diffusion of heat. Hence, with a continuous illumination there would be an uninterrupted decrease in the volume of heat. In the progress of time, this constant radiation and reduction of heat would produce perceptible results; the time of the manifestation of which we have designated as the Zonular Stage of the Prozoic Age. Prior to this—that is to say, during the Chaotic Stage—the whole material universe was diffused throughout "the star-sown vague of space" as one enormous gasiform, nebulous gathering. The reduction of heat and chemical action were syner-

gistic agents in the production of the Zonular Stage, Through the oper of the latter, the constituent elements of the universe would form num and various combinations, the number and nature of which would depend the natural affinities of the elements, and the relative proportion in which were respectively present in the admixture of gases and vapors. Simultar with the reduction of temperature these newly-formed substances woul disseized of the power of retaining their former gaseous form; and, thr the influence of this liquefacient, would be condensed into a molten-l sphere, incarcerated within an atmosphere constituted of such volatile pounds as could retain their gasiform condition, maugre the reduction of perature. Throughout the liquid sphere thus formed, and its circumj atmosphere, alike, would occur an expatriation of that uniform density diffusion which prevailed during the Chaotic Stage. This was immediately ceeded by the intromission of the characteristic from which the second Zonular—stage derives its name, to-wit: the arrangement of the dissimila newly-formed compounds—in compliance with the requirements of the la gravity—more or less completely in strata or zones, according to their respe densities. The layers of the stratified liquid sphere and its cinctured a phere may be arranged, commencing at the centre of the earth, as follows

I.—*Mineralogical Strata.*

1. A central metallic nucleus of very great density, surrounded by a consisting of combinations with sulphur, arsenic, etc., and the l metals.
2. A zone of molton rock, considerably lighter than the former, a which "the silica, present in minimum proportions, existed in c nations with a large amount of the bases—lime, magnesium, ox iron, and alumina—with but comparatively little potash," and
3. An exterior zone of molten rocks of comparatively little density, " sisting of silicates, in which an excess of silica was to a great e combined with alumina and alkali, but containing very little other bases."

II.—*Meteorological Strata.*

1. Such compounds as are volatile at a very high temperature only; as the clorides, for example, and particularly the cloride of sodi the chemist's name for common salt;
2. A great zone of carbonic acid gas;
3. A belt of nitrogen with an admixture of oxygen; and
4. In the form of vapor, all of the water that now forms the sea oceans, constitutes the lakes and rivers, and all that saturate earth and atmosphere.

The mineralogical stratigraphical arrangement of the molten sphere very properly be considered as approximately stable, since it was one was not destined to be broken up by refrigeration, brought on by the rad of heat and the heat-absorptive power of the surrounding atmosphere.

The meteorological stratigraphical arrangement, however, was quite different. Here the individuality of the strata was, in all probability, broken up, alike, by the tendency of diffusion and actual congelation.

When this sphere had acquired an indubitable permanency of configuration, it may be presumed to have passed to the third stage in its Prozoic progress. The process of refrigeration, commenced during a former stage, was not interrupted by the transition, but continued in full operation, retaining all its force and efficacy. Under this persistent influence, a thin crust or film would soon be formed over the surface of the molten sphere. By a continuation of the same causes the film thus formed, constantly receiving accretions, gradually interposed a greater and greater impediment to the radiation of heat from the interior of the slowly-cooling mass, until the process of radiation was materially impeded; and eventually the earth's crust was reduced to a temperature below red-heat. With this reduction of the temperature of the earth's crust, there would be a corresponding reduction of the temperature of the atmosphere. Consequent upon this reduction of the temperature of the atmosphere was the condensation and precipitation of some of those elements which had previously been held in suspension in the lower strata of the atmosphere; such, for example, as the clorides, and more particularly the cloride of sodium or common salt. "From the amount of salt contained in the ocean and known deposits, it has been estimated that the quantity of common salt alone would be sufficient to cover the entire sphere with a layer some ten feet in thickness."

As refrigeration progressed, and the temperature of the atmosphere became reduced, and the gathering and congelation of the gaseous particles was inaugurated, a scene of terrible sublimity was ushered in—such a scene as human eye never beheld, and one which earth was destined to witness but once. Wisps of *cirrhi* swept along the unobstructed cerulean concave; vivid and angular flames lit up with scarlet the Cimmerian gloom; while the deep-toned thunder—nature's magnificent pipe-organ—ever and anon, in world-convulsing crescendoes, pealed forth its sublime and terrifying melody. The *cirrhi*, that at first did scarce stain ether, gradually deepened, and, by swift degrees, spread a thick coat of distended *nimbus* o'er the canopied void of heaven. The clouds open and the vernal shower descends in one unbroken sheet, but, like the light of a comet, vanishes in mid-heaven, and is returned to the upper regions, whence it proceeded. Again it approaches the earth's blackened and arid crust, and again it is scorched to evaporation and returned to the clouds, which were then overburdened with all the water that now fills the oceans and seas and lakes and rivers, and all that saturate the earth and rock and atmosphere. Eventually in the fierce conflict between the two elements—fire and water—the latter prevails, and the whole ocean is precipitously transferred to the parched crust of the famishing earth. This seething ocean dissolved the encrustment of chloride of sodium, and with the cessation of its evolutions it had acquired a salineous quality, which it has ever since retained.

The peculiar characteristic of color yet remains to be considered in deavoring to account for the origin of the ocean.

The ocean may properly be said to have eleven distinct colors, which be tabulated as follows :—

I. Green : (1).	II. Indigo : (7).
a. Clear-green (2).	*a.* Cobalt-blue (8).
b. Bright-green (3).	*b.* Deep-indigo (9).
c. Strong-green (4).	*c.* Black-Indigo (10).
d. Yellow-green (5).	III. Black (11).
e. Dark-green (6).	

Upon minute examination we ascertain that each of these various co except the last, is produced by impurities mechanically suspended in the w The greatest amount of suspended matter produces the green, and each ceeding tint, in the gradual shading off into pure black, is marked by a co ponding diminution in the amount of suspended matter until, in the bla theoretically at least—all impurities disappear. If the particles of suspe earthy matter become very numerous and gross, to designate that fact we a the term "muddy." The blackness of water—which is indicative (1 depth, and (2) of purity—has been accounted for by Prof. Tyndall as foll "In small thicknesses water is sensibly transparent to all kinds of light ; b the thickness increases the rays of low refrangibility are first absorbed, after them the other rays. When, therefore, the water is very deep and pure, *all* the colors are absorbed, and such water ought to appear black, light is sent from its interior to the eye."

So much for its origin. Let us now consider

THE DESTINY OF THE OCEAN.

In endeavoring to prognosticate the destiny of the ocean, we cannot more judiciously than to draw our predictions from the portent of na No celestial body, of telluric contemplation, is more adapted to our pur than the moon.

The moon is a companion planet, accompanying the earth in its jou round the sun. It had an origin in common with the earth, and posse during some stage of its progress to complete refrigeration—for it is only *cadaver* of a planet, the wreck of a worn out world, and destined, Stanis Munier predicts, to be precipitated to the earth in showers of stones— present prevailing characteristic of the earth. In other words, its surface once swept over by a humid atmosphere, and bathed in a tepid ocean. I of these was subject to the laws of thermal equilibrium; both have been gulfed in the process of complete refrigeration. But let us not anticipate, will be fully developed in the sequel.

It is now universally conceded that the moon once possessed both ocean and an atmosphere. To explain their disappearance several the have been brought forward. Of these the following deserve our attention :

Whiston has suggested that the lunar ocean and atmosphere have been swept away by a comet. With the progress of scientific knowledge and discovery this hypothesis has become antiquated and untenable. From our present knowledge of the nature and constitution of comets, we know this to be utterly impossible.

There is another theory scarcely more plausible or tenable. It has been suggested that the moon has grown so intensely cold, that all life—animal, vegetable, and "the life that our imagination pictures where great natural changes are in progress"—has become extinct, the air condensed and precipitated, and the ocean congealed to its utmost depths. The facts evolved by Lord Rosse's experiments completely confute this theory. It is very probable that the superlative gelidity of the long lunar night, would, if continued without cessation for a space of time equal in length of duration to said night, solidify the once-existing lunar ocean, and congeal the various gases of its formerly existent atmosphere; but the intense heat of the long lunar day, precipitated without intermission, for a space of time equal in length of duration to fourteen of our days, would undoubtedly liquify the congealed ocean and vaporize the frozen atmosphere. Telescopic observations reveal the fact of the stability of the moon's phenomena. If there actually was a vaporization of a frozen atmosphere and a liquification of a congealed ocean, there would be, if not palpable manifestation of the actual mutation, at least a perceptible change in the observable phenomena of the moon. Since there is no observable disturbance—in as much as there is at the time of the full-moon no perceptible signs of change, we may very rationally conclude that there is neither lunar ocean nor lunar atmosphere; at least none on that portion of the sphere visible to us.

There is another ingenuous theory which, though no less startling than those already enumerated, has obtained signal credence with some astronomers and scientists of repute; and for this reason, if for none other, is deserving of careful and attentive consideration. This theory proposes as an explanation for the disappearance of the lunar ocean and atmosphere, their withdrawal to the opposite and unseen side of the moon. Now, this is not a fanciful conjecture based upon either our profound ignorance of the opposite or unseen portion of the moon, or the tacitly reiterated principle *omne ignotium proriforate magnifico*, and adduced to evade some inexplicable mystery, but founded upon observable appearances, and supported by incontestable phenomenal facts. We do not contend that the theory is indubitably *true*, but that it is not without a *probable*—slight though it be—foundation.

This theory was first suggested by a profound investigation of Hansen, the ingenious German mathematician. His investigations led him to conclude that if the moon's centre was not at the middle of the earth-directed diameter, the fact would be evinced by her movements. After extensive investigations and long and patient observations, Hansen finally obtained sufficient evidence to justify the conclusion that the moon's centre of gravity is more than thirty miles farther away than the middle point of the earth-directed diameter. Now if the

shape of the moon is that of globe or sphere, the side towards which the of gravity is moved, must be considerably heavier than the opposite one. not this inequality of weight have been occasioned by the withdrawal ocean and atmosphere to the weighty side? In the event of such a passage would be a coercion of the ocean and atmosphere to twenty-one fiftieths entire surface of the sphere, or else some of the attendant phenomena of water would be manifested to our telescopic vision; for in her vibratio moon tilts first on one disc and then another towards the earth, with rega successive alternation, so that in reality there remains but twenty-one fifti the sphere that remains altogether and at all times unseen.

Sir Isaac Newton long since demonstrated that, theoretically at lea moon is elipsoidal in shape. Latterly, Gussew, having carefully examined scopic views of the moon—produced by combining photographs of the when in opposite stages of her librations, which were taken by De la Ru his powerful reflector—and by carefully noting the displacement of the and the other discernable characteristic features, has succeeded in obtai method for determining the lunar contour. According to this method of me ment, the greater portion of the earth-directed disc must be regarde mountain excresence, which attains, at its greatest altitude, an elevation of seventy miles above the mean level.

Now, if this is the true contour of the lunar surface, we must, pe abandon the idea that there is either ocean or atmosphere upon the sur the moon; for if they exist anywhere it is evident it would be around th of this prodigious protuberance; and under this circumstance, the moon ble disc would be a girdle of water. Since there are no manifest s atmosphere or water on this portion of the lunar surface, we are warran concluding that the moon is devoid of both. Hence we are justified in ing, as utterly untenable, that theory which contends for this withdraw the opposite and unseen surface of the moon.

We have not yet exhausted the theories put forward to explain the pearance of the ocean and atmosphere from off the surface of the moon Frankland has suggested that the ocean and atmosphere have withdrawn to the posterior portion of the moon, but—to the interior. This theory Frankland's, variously modified, is obtaining great favor in the scientific and is doubtless destined to supersede, for a season at least, all others.

If we repose with confidence in the nebular hypothesis, and acc legitimate the evidences, reasonings, and conclusions of Meyer, whatever ideas we may entertain respecting the past condition of the earth and the members of the solar system, we cannot reasonably withhold our assen that theory which represents all the members of the material universe as d throughout space in a gasiform condition. At this period the vaporous which developed respectively into the earth and the moon, were confined the same incarcerating gaseous envelope. But this pellicle envelope gra contracted, the chains of immurement gradually fell from the earth ar

moon, and thence forward they existed as distinct spheres, subject to the same laws of thermal equilibrium. In compliance with the requirements of these laws, the moon, being much smaller in bulk than the earth, consequently would cool much more rapidly than the earth. It is presumable that while the earth's surface was still aglow with heat, the moon frowned upon her with a corrugated and gelid brow.

From analogy we know that this cooling of the moon's must have been attended with contractions, which "can scarcely be conceived of as accruing without the development of a cavernous structure in the interior. Much of this cavernous structure would doubtless communicate, by means of fissures, with the surface, and thus there would be provided a receptacle for the ocean, from the depths of which even the long lunar day would be unable to dislodge more than traces of its vapor. Assuming the solid mass of the moon to contract on cooling at the same rate as granite, its refrigeration through only 180 degrees of Fahrenheit's thermometer (the difference between the boiling heat and the freezing point) would create celular space equal to nearly fourteen and one-half millions of cubic miles, which would be more than sufficient to engulf the whole of the lunar oceans, supposing them to bear the same proportion to the mass of the moon as our oceans bear to that of the earth."

Without laying any claim to prescience, but by simply accepting the previsioned history—evolved by lunar facts—of the material universe, we are enabled to record, with some degree of certainty, the ultimate destiny of the ocean. In the process of complete refrigeration, the water which now percolates towards the earth's centre, and which exists, in consequence of the internal heat, alternately in the form of water and vapor, a circulation being kept up in this alternation of form occasioned by the heat constantly repelling the approaching water—will follow the receding of the intensity of the earth's internal heat, and, as Winchell remarks, "will circulate deeper and deeper. When the thickness of the terrestrial shell which must be saturated with water, has doubled, the increased demand must lower the waters of the ocean, and long before refrigeration has reached the centre, the thirsty rocks will have swallowed the seas and all our surface waters. The drained, and shrunken, and shivered zone lying near the surface will suck in the atmosphere, and this will disappear in the pores and caverns of a worn out world," and the earth swung in the midst of space, the mere *cadaver* of a planet—its lights extinguished—its glory departed—will continue its rapidly circling and precipitous descent to the sun, the centre from whence it sprung, and to which it is destined ultimately to return.

An expedition is being fitted out in Russia, and will set out during the coming summer, to investigate the character of Behring's Sea and the waters contiguous thereto, to determine how far a line of communication may be practicable between Siberia and Scandinavia. The discovery of a northwest passage to the Yenesei is of great importance to Russia.

GREAT GREY OWL.

THE GREAT GREY OWL.

(*Syrnium Cinereum.*)

Come with me to one of the great dense forests that cover with an unb veil of green, thousands of square miles of North America.

Perhaps no place can inspire the imagination with livelier feeling bring out whatever is romantic or superstitious in our natures than the in of those dense forests of the northern portions of our continent. The sol and the dim, uncertain light, where the bright beams of the sun seldom trate, save here and there in some chance opening in the dense canopy of laced limbs and green leaves above the gloomy darkness, being relieved o flickering streaks of light which struggle in vain to reach the damp moss-co ground beneath, where not a sound breaks the awful solitude save the sigh the breeze in the tall tree-tops or the crack of some broken limb, or perc the crash of the fall of some forest monarch which after a long life dr decay on the damp ground below, or anon the cry of some wild creature l one of the forest glades deep in its inmost recesses. But it is at night th forests are seen to their greatest advantage: the tall trees stand out like sentinels in the moonlight, while the dark dismal glades and recesses see fit abode of genii or spirits evil and unknown; the cry of the panther or the of the wolf sound from some distant part of the wood, while at interva almost human scream of the American lion is heard shrill and clear in the air as it echoes and breaks the stillness, the ghost-like forms of many silen spirit-winged night birds flit noiselessly like spectres past us.

Such is the home of the Great Grey Owl, who delights in the de deepest woods.

This is the largest owl found upon the continent. Its great size m seen from the measurements found at the end of this article, where a de description is given. This was taken from the largest and finest of many s mens examined by the author.

The flight of this bird is firm, silent, easy and long sustained. Flitti noiseless, light and spectre-like wings, it glides through the deep, dark av of the woods, or sits upon one of the uppermost branches and glances with its large bright eyes for some of its nocturnal prey.

This owl is confined to the northern portions of North America. seldom seen in the United States, and then only in very cold weather, exc Washington Territory, where it is said to be resident. It is quite comm British America from Hudson's Bay to the Pacific, and in some porti Canada. A few specimens have been taken in New Jersey, Ohio, Pennsyl and in all the New England States. It occasionally utters a tremulou something like the note of the Mottled Owl. It hunts by night and s during the day in deep recesses of the forests. Its food consists of rabbits, and other small animals. Its nest is in tall trees, and composed of stick

mosses and lined with down. The eggs are four, dull white, more pointed at one end than the other. Size of eggs, 2.25 inches long by 1.78 wide.

In all ages and at all times the owl has been regarded with a sort of superstitious dread. Seldom seen except in the uncertain twilight as dim and flitting spectres, or uttering strange and melancholy cries in the deep shades of night from the depths of gloomy forests or ghastly ruins, or as perched on the black moss-covered crumbling tower of some ghost-haunted castle, they very naturally become objects of awe and dread. Their strange forms, large heads and staring eyes, their uncouth gestures and noiseless flickering flight, together with their melancholy and discordant notes, are sufficient to excite the awe of most beholders. It is the mission of Science to dissipate such superstitions and reveal the true nature of the objects which God has created. The owl, when truly and faithfully known, is calculated to excite not only wonder, but admiration. When its true nature becomes known, it is found to be so well adapted to its mode of life and the purpose of its creation as to excite the admiration of all who become acquainted with it. So far from being the enemy of man, it is one of his best friends. Living on noxious animals that devour our substance, it is the protector of our fields and granaries; instead of a loathsome monster, it is an elegant, well-conditioned bird. Its moral qualities are most exemplary. The owl is created for the night; daylight to him is hurtful—it is his night. In the light of the sun he becomes blind, and his motions are awkward and stupid; but as soon as night approaches he is all activity, grace and ease; he glides about as noiseless as a shadow. The large eyes, before so vacant and expressionless, become now full of expression and life; in fact he is admirably adapted for the night.

There are over one hundred and eighty species of owls described. They inhabit all countries and climates, from the desolate polar regions to the sunny tropics.

DESCRIPTION OF THE GREAT GREY OWL.

The Great Grey Owl is twenty-eight inches long, the upper parts are a dark vandyke brown, relieved by transverse mottling of white, the centre of each feather plain; winglet and wing coverts crossed by indistinct bars of a paler brown; primaries brown, crossed by nine transverse series of quadrate spots; of mottled grayish brown on the outer webs, pale near the tips; the terminal bar is more distinct; secondaries crossed by nine bars of grayish white, the last terminal; tail brown, crossed by nine paler bands, mottled quite profusely; under parts grayish white, each feather with a longitudinal streak of dark brown; vent plain; legs and feet thickly covered with feathers to the claws, and of a pale brownish white with fine irregular transverse brown bands; sides under wings, vent and lower tail coverts crossed by transverse brown bands; facial disc greyish white with distinct concentric semicircles of blackish brown; a dusky brown spot at the anterior angle of the eye; eyebrows, lores and chin white; circle surrounding facial disc dark brown, becoming white across the fore neck, where it is divided by a brownish black spot

covering the throat; iris yellow; bill yellow; six outer wing quills, with inner webs emarginated.

DETAILED MEASUREMENTS.

Wing carpal joint end primaries, 18 1-2 inches.
Wing carpal joint end secondaries, 14 inches.
Tail, 12.50 inches.
Tarsus, 2.30 inches.

Middle toe,	1.60 inches;	claw,	1 2-8 inch	}	On curve.
Inside "	1 "	"	1 2-8 "		
Outside "	.6-8 "	"	1 "		
Hind "	.5-8 "	"	1 1-8 "		

Bill, 1 7-8 inch.
Graduation of tail (middle longest,) 1 1-2 inch.
Tail extends 2 inches beyond end of wings.

Fifth wing quill longest, first equal to secondaries and four inches shorter than longest.

Tail contained 1 1-2 times in wing; middle toe half as long as tarsus equal to bill on top curve.

THE GREATER LIGHT.

Placed in the centre of the solar system; being the source of light, heat, and all vital action, either animal or vegetable; the origin of all mechanical power on the earth; producing winds, tides, currents; lifting water that falls again in rain, snow or hail, dew or fogs; the origin of electric or magnetic forces, the sun is the most important and glorious object in the heavens—for long ages it has been worshipped as a god—shining so brightly that the most brilliant of all artificial lights appear as black opaque objects when held before its glowing face, and giving out heat that reaches and warms the most distant of its planets, it may well receive our most careful study.

The distance of the sun from the earth is, in round numbers, 92,000,000 miles *; a distance so great that a locomotive, moving at the rate of twenty miles an hour, would take more than 500 years to reach the sun. The apparent diameter of the sun is 32 min. 33 sec.; its linear diameter 853,000 miles. It would require 112 globes of the size of the earth, if placed side by side, to reach across the face of the sun. A steamship, moving at the rate of twenty miles an hour, would require more than five years to sail across the solar disc. The sun is about 1,400,000 times as large as the earth. The moon being 238,000 miles from the earth, were the centre of the sun made to coincide with the centre of the earth, the sun would extend every way from the moon nearly twice as far as the moon.

In density the sun is only one-fourth that of the earth; not much more

* 91,348,600 miles; its circumference 2,671,000 miles. Its shape is a perfect sphere.

than water. The sun outweighs the combined masses of all the planets which circle around him fully 740 times. The quantity of matter in the sun is 355,000 times as great as in the earth. A body, therefore, would weigh nearly twenty-eight times as much at the sun as on the earth. At the surface of the earth a body falls through 16 1-12 feet in a second; but a body would fall at the sun, in one second, through 448.7 feet.

The surface of the sun, when viewed with a telescope, usually exhibits dark spots, surrounded by a lighter border, which vary much at different times, in number, size and shape. More than a hundred assembled in several distinct groups are often visible at once on the face of the sun. These spots are usually confined to a zone, extending across the central regions of the sun, of about sixty degrees in width. They are observed to move across the disc of the sun, occupying about two weeks in passing from one side to another. After an absence of about the same time they reappear, having taken 27 days 7 hours 37 minutes in the entire revolution. They usually appear first on the eastern limb of the sun, and pass over to the western side, where they disappear.

The spots are composed of a dark nucleus, called an umbra, surrounded by a lighter-colored border or penumbra. They are sometimes seen to burst asunder and project fragments in all directions. The number and size of these spots vary considerably in different years. The times of their greatest abundance occurs at intervals of about eleven years. Several umbra are often enclosed in a single penumbra; the light grey penumbra appearing to make bridges across the dark umbra. Sometimes there are penumbra without umbra, and umbra without light borders. The dark umbra has often still darker spots called nucleus. The duration of the spots is variable; some appear and vanish in less than twenty-four hours, while others have existed for weeks or even months; while again their number is also exceedingly changeable. Sometimes the whole disc is entirely free from them, while again hundreds may be counted in view at the same time.

Curved and branching streaks, more brilliant than the rest of the sun, quite distinct in outline, and separating into ridges and network, are often seen near large spots, or where spots have been or are to be seen. They are called faculæ, and are of all sizes, from slender tracts, 1,000 miles long, to complicated heaped-up ridges, 40,000 miles long and 4,000 wide. They are proved to be mountainous ridges of luminous matter raised above the general surface.

The general surface of the sun has a mottled appearance. It seems to be composed of patches of light, separated by minute dark spots, called pores. These luminous masses or spots are oblong in shape, and are compared to willow leaves or rice grains. They may be distinct masses of matter or waves or billows in the grand ocean of flame. They are not seen in the faculæ; but similar forms surround the margins of the penumbra, stretching towards the interior of the spot.

In a total eclipse a halo of white light surrounds the sun. It has a radiated appearance, seeming to proceed from the sun. It has a rosy tint near

the edge of the moon, and at about the distance of the radius of the s fades into the surrounding space. Streamers of light also shoot out from all directions into space. The polariscope shows that the corona, as this halo of light is called, and the streams of light are reflected light, but what is not yet ascertained. At the same time rose-colored, scarlet, purp white flames issue from behind the moon and shoot out into space. assume various shapes—some pyramidical, others curl over like a sick shape. These flame-like protuberances are of all sizes, from mere dots to streamers of 80,000 miles. They are seen sometimes detached from the floating, as it were, like clouds; at others, like long flames, blown by a s wind. The causes of these several phenomena are yet to a great d subjects of speculation. Some attribute the rose-colored flame-like emana to gaseous matter in a high state of combustion. The spots upon the su of the sun have been supposed to be openings in a fiery, gaseous envelop rounding the dark opaque body of the sun, through which its black su could be seen. Others attribute them to clouds of darker matter floating fiery atmosphere. Whatever they may be, it has been found that the appa darkest parts of the spots are yet very brilliant, and give out heat and ligh appear dark only in comparison to the brighter surface of the sun.

It is found that all parts of the sun do not give out heat and ligh same, some being much brighter than others, for instance, the equatorial re are more intense than the polar, and the central parts of the sun give heat than the margins. The black spots are not so hot or light as the br surface of the sun. The light from the penumbra is less than half that the general surface, while that from the nucleus is less than one-hundre the light of the bright surface of the sun. The heat and chemical rays the same rule.

The best received hypothesis of the physical condition of the sun i it is a solid body surrounded by three atmospheres. The first of thes velopes is an elastic medium, bearing a dense bed of vaporous clouds; o top of this shell floats a luminous stratum or photosphere, composed o connected phosphoric clouds, and subject to constant fluctuations, both local causes of agitation and from the subjacent vapour acting by its ela to burst through the photosphere above it, thus producing the appearanc as spots on the sun. The faculæ which are found to be above the genera of the photosphere are supposed to be heapings up of the luminous mas if boiling up in great bubbles, or like the crested waves of the ocean. envelope is many thousand miles in thickness. Over all is a third and shell or envelope of imperfect transparency, and of great thickness, conta in a vaporous condition, iron, sodium, lithium, and various other metalli stances. All these strata are subject to great agitations and movements, are sometimes of the character of regular progression, similar to our winds, and sometimes irregular, violent and sudden, analogous to tornad whirlwinds. This outer transparent shell is more than one-tenth o

diameter of the sun, and in it are found cloudy masses, of extreme tenuity, floating at various elevations, sometimes rising to 80,000 miles above the sun; and these gaseous clouds are the cause of the flame-like protuberances. All the investigations of astronomers show that great and sudden changes are continually passing upon the surface of the sun, and that its envelopes are of a very gaseous nature in a highly heated state. What effect, if any, the absence or presence of spots upon the surface of our luminary has upon the earth, or its inhabitants, is yet undecided. It has been supposed that the planets Jupiter, Saturn and others may, at certain periods, have an effect upon the frequency or absence of spots, yet, I think, this is now not very generally believed. The appearance of Bailey's beads, or certain dark protuberances seen upon the edge of the moon at the time of an eclipse, are now supposed to be occasioned by the defect of the telescope or eye of the beholder, or maybe the effect of the earth's atmosphere.

Such is a hasty and brief sketch of the physical condition of our great luminary. A description of its effect on the tides, the constitution of its rays, their chemical effect, etc., would carry this article far beyond its prescribed limits. The sun's agency and effects are felt in every part of nature—animal, vegetable and mineral.

Its rays have been separated by the spectroscope, and iron, nickel and many other minerals found to be in the sun. What keeps alive the intense energy of the sun? What supplies its ever-burning heat and light? These are questions yet far from being satisfactorily answered. Some attribute it to chemical action, others to the supposed contraction of its size, while, finally, it has been supposed to be supplied by myriads of small planets or comets falling upon the surface of the great luminary, attracted by its superior power.

Astronomy, like its sister sciences, has yet much to gain by investigation. Much has yet to be learnt; and what science is more grand, more awe-inspiring in its teachings? The astronomer, indeed, seems to be lifted upon wings of thought, and carried far above the littleness of this small globe, to contemplate the grand objects of the heavens.

In concluding this article, I would say that the sun has three true motions: One an axial motion, by which it rotates on its axis, in 25 days 8 hours and 9 minutes, the axis being inclined to the plane of the ecliptic, 7 deg. 9 min.; Another a sort of orbital motion around the centre of inertia of itself and its planets, but, on account of the great superiority of its mass over the aggregate mass of all the other bodies of the solar system, this centre of inertia is always within the body of the sun; And, thirdly, a progressive motion in space, in the direction of the constellation Hercules, and at the rate of 154,185,000 miles a year. Thus the sun travels, attended by all its system of planets, satellites, and comets, like a royal monarch accompanied by his retainers. By many astronomers it is thought that the sun is revolving in a great orbit around some other sun as a centre; thus accounting for the progressive motion in space.

A LIST OF SOME BIRDS OBSERVED IN THE VICINITY OF MINNEAPOLIS, MINN., NOT ENUMERATED IN DR. HATCH'S LIST.

BY THOMAS S. ROBERTS.

[Communicated by Robert Ridgway.]

1. *Turdus fuscescens.* Probably common.
2. *Regulus satrapa.* Occasional, during migrations.
3. *Sitta Canadensis.* Rare.
4. *Cistothorus stellaris.* Rare summer resident.
5. *Helminthophaga chrysoptera.* Rare summer resident.
6. *Helminthophaga peregrina.* Abundant during spring migrations.
7. *Dendroica blackburniæ.* Occasional during migrations.
8. *Dendroica striata.* During migrations.
9. *Dendroica tigrina.* During both spring and fall migrations. specimens taken.)
10. *Myiodioctes Canadensis.* During migrations.
11. *Coturniculus passerinus.* Common.
12. *Euspiza Americana.* Abundant during the summer of 1874, b visited us in 1875.
13. *Zonotrichia querula.* While riding through an open, scrubby se country some seven or eight miles from Minneapolis, on the 9th of May, saw large numbers of this species. Two were shot, one of which is in t session of Dr. P. L. Hatch. On the 16th of the same month I obtai last specimen that has been seen in this locality, although constant ar ough search has been made each succeeding fall and spring.
14. *Cardinalis Virginianus.* A brilliant-plumaged male shot on the October, 1875, in the midst of the large woods about six miles from Minn
15. *Contopus borealis.* Rare summer resident.
16. *Hylotomus pileatus.* Common in heavily timbered sections.
17. *Sphyropicus varius.* Common in heavily timbered sections.
18. *Actodromus bairdi.* Several specimens taken.
19. *Calidris arenaria.* Shot by Mr. W. L. Tiffany on sandy bea lake near Minneapolis, September 22nd, 1875. (Specimen in my collec
20. *Sterna forsteri.* Not common.

A cow, in the town of Eden, the mother of a handsome calf, was t the railroad a few days since. She had cleared the last rail when the p train appeared. The animal hastened towards the fence. Looking b saw her offspring standing on the track. With a frightened look she piteous but useless appeal to the foolish little creature to follow her. (the train, and still stood the calf, by this time facing the train. The e tried to scare the little fool away by making the whistle scream, but he v scare. When the train was within ten rods of the calf the cow made a her silly child, caught him on her horns, and bore him away in safety.

BIRDS OBSERVED IN THE VICINITY OF OAKLAND, CAL., DECEMBER 23, 1872.

E. W. NELSON OF CHICAGO.

The following observations were made during a day's collecting, in the vicinity of Oakland, Cal., where myself and friend, Mr. W. Wentworth, were stopping for a few days, the last of December, 1872.

The principal portion of the day was spent on an arm of San Francisco Bay and the adjacent marshes, which are extended along south of Oakland. A dense fog covered the bay early in the morning and confined us to the shore. The time was pleasantly spent, however, in examining the town, which is pleasantly situated on a slope commencing at the bay, on the south and west, and rising gradually to slight hills, just back of town, and a few miles to the north increasing to a low range of mountains.

The only timber to be seen was the belt of oaks extending along near the bay, and in the midst of which, the town is situated.

It seemed very curious to us to see the plants in the gardens full of blossoms at this season of the year, and as though to mimic summer still closer, several Anna Humming Birds *(Calypte Anna)* were darting about among the flowers.

As we proceeded toward the outskirts of the town a small flock of Purple Finches *(Carpodacus pontalisvar rhodocolpus)* lit in an oak and looked unsuspiciously at us as we passed underneath.

On the edge of the town we found a small lake made by building a dam across the outlet of an arm of the bay, which extended back a mile or more from the main body of water. This lake appeared to be the home of numerous water fowl, notwithstanding there were several residences on its banks and a much frequented road extending along one side.

On two oak trees near the lake several White Pelicans *(Pelecanus trachyrhynchus)* were pluming themselves. In the centre of the lake a large flock of ducks were splashing about, seeming to well understand that they were under the protection of the law. On the shore near by a flock of Semi-palmated Sandpipers *(Ereunetes pusillus)* ran nimbly about, and on the opposite shore a White Heron *(Ardea egretta* var. *Californica)* stalked sedately along.

The fog showing signs of dispersing, we hastened back to our boat. As we walked out on the wharf we saw several grebes (including the two species *Podiceps occidentalis* and *P. Auritus* var. *Californicus*) swimming near. Observing that they had not seen us, we concealed ourselves and watched their movements. They appeared to be intently scanning the surface of the water about them, which was soon explained by the movements of one of the grebes. A school of minnows passing near them was at once seen, when the grebe quietly disappeared and suddenly there was a great commotion among the minnows. It was evident from the manner in which they leaped from the water and darted about that they well understood their danger. Presently the grebe reappeared with a struggling victim which he quickly swallowed, and noting the direction taken by

the survivors, was soon among them again. Once the grebe followed i so close to the wharf that we could see both. At first the minnows t escape by scattering and darting down into deep water, but the grebe out one and gradually drove it toward the surface, all the time drawing and just as the minnow was about to leap from the water it was caught.

The fog being now nearly gone we pushed off in our boat. As we out from shore immense numbers of ducks arose from the water, in every tion, and after wheeling about a few times the most of them started off. they circled by we recognized several species. The Scaup Duck *(Fulix a* and Widgeon *(Mareca Americana)* appeared to be the most numerous. were also many Buffle-heads *(Bucephala albeola)* and Gadwalls *(Chaul streperus,)* while from the marsh came the familiar "quack" of the M *(Anas boschas.)*

Just in advance we noticed several large waders on a point of lan rowed over near them. They proved to be Willets *(Symphemia semipa* which on our approach seemed to appoint themselves a special comm investigation, hovering overhead and keeping up a continual outcry, as warning all the inhabitants of the marsh to beware of us.

After a pair of them were shot the rest left, at once, for a safer l Pushing the boat up into a narrow strip of grass bordering the marsh w greatly amused by the actions of a large Rail *(Rallus longirostris;)* as t of the boat was pushed up into one side of the strip of the grass the R great deliberation walked out of the other side, only one or two yards vance, and after looking at us in apparent amazement for an instan menced gravely walking toward a bunch of rushes a short distance away. step was taken very carefully, the foot being raised slowly and placed g advance, the bird all the time looking as though it were in deep meditati did our shouts and rattling the oars about have the least effect on its pe

Landing, we started toward a distant bridge on which several Blue *(Ardea herodias)* were standing. With characteristic shyness they de close intimacy and flew long before we were within gunshot. Occasionally son's Snipe *(Gallinago Wilsoni)* sprang from a muddy spot and darted we walked along, and from the grassy pools numbers of Mallards and Sp *(Spatula Clypeata)* flew noisily off on our approach.

A low whistling cry from a depression, to one side, attracted our att and on our approach we were astonished to see a large flock of Lon Curlews *(Numenius longirostris)* and Marbled Godwits *(Limosa Fedoa* and fly away. After flying a short distance they turned and came near for us to secure a fine Curlew.

A flock of large Terns were standing on a bare mud flat, but on pearance they arose and flew over, coming so near that one was wing heeding the deafening cries of the wounded bird, its companions kept on and soon disappeared.

To our satisfaction the Tern proved to be a fine specimen of *Sterna*

Several Black-bellied Plovers *(Squatarola helvetica)* were observed on a piece of pasture land near the marsh, and after considerable effort one was obtained.

In the afternoon, as the tide fell, leaving long strips of mud flats with here and there pools containing small fish and other edible matter, the water fowl commenced coming to the feast, and soon the flats were swarming with ducks, mergansers and gulls, which kept up a continual quarreling and running about, making a great noise.

Among the gulls, *Larus philadelphia* was the most numerous species, but *L. argentatus* var. *Occidentalis* and *L. delawarensis* var. *Californicus* were abundant, and several Short-billed gulls *(L. canus* var. *brachyrhynchus)* were observed, and one specimen obtained.

Towards evening numbers of Goosanders *(Mergus merganser)* and Scoters *(Oedemia perspicillata* var. *trowbridgii)* came into the open water.

Near sunset, several Brown Pelicans *(Pelecanus fuscus)* commenced fishing near the ruins of an old wharf, which was built out in the bay. From the appearance of these birds, while standing, one would form the opinion that they must be very ungainly flyers; yet the contrary is the fact, for their movements in the air are far more light and graceful than those of many birds which look much lighter and seem more capable of easy flight. They first made their appearance from the west, and as they approached the fishing grounds they set their wings and with their head drawn back upon the body, the bill extending forward over the breast, came gliding along for a considerable distance.

After circling about a short time they descended and commenced fishing. Flying along ten or fifteen yards high they carefully examined the water below, and when their prey was observed they would turn and nearly closing their wings dart down into the water and appear to strike on their breast, at the same time thrust their bill forward to capture the fish. Then rising lightly from the water they would repeat their operation. They were quite unsuspicious and allowed the boat to approach within gunshot, when a pair were easily brought down.

The sun sinking behind hills in the direction of the "Golden Gate" warned us that it was time to turn our boat homeward, and we reluctantly bade farewell to one of the pleasantest days we had enjoyed for some time.

A PREHISTORIC ROAD.—Several years ago portions of an ancient macadamised road were discovered on the banks of the Monongahela River, near Fairmount, West Virginia; and, on a recent exploration by Government surveyors, it was traced for nearly eleven miles along the bottom land between the river and the hills. Its width is fifteen feet; it is composed of boulders of red sandstone, which must have been brought from a distance, there being few if any boulders in or near the river. It is supposed that the stones were broken into pieces by first heating and then throwing water upon them. The depth of broken stone is about eighteen inches. At many points there are large trees, over 150 years old, growing in the road; showing that it was built long prior to the advent of the white man in this country.

A CHAPTER ON TREES AND FORESTS.

BY W. H. MACHEN.

None of the many grand and imposing features, in which the geogr this country abounds, was more apt to inspire the early explorers and p with astonishment and awe, than the vast and unbroken forest extendin the shores of the Atlantic to the fertile plains of the far-West, and fr North-lands of Maine and the great lakes, which yet had borne upon th lows none but canoes and batteaux, down to the far south where cypres magnolias, amidst a most luxuriant vegetation of every description, bathe roots in the tepid waters of numberless lakes, ponds and bayous, as th with the tide of the Mexican Gulf.

In this grand and well-nigh impenetrable expanse of forest, unbroke by mighty rivers, which flowed between hills and mountains or force tortuous course between forbidding crags and precipitous rocks, many re species of trees indigenous and peculiar to this country, were represen millions of specimens of primeval growth, in the full splendor of natur fection. Here and there, in specially favored localities, nature, as if to herself, had produced trees of extraordinary size, towering far above, an shadowing the surrounding vegetation. These might be compared wi most renowned for extraordinary proportions in any portion of the globe let us not suppose that, to behold giants of the vegetable kingdom it was sary to travel to foreign countries; visit the wilds of Africa, to survey th and immense spread of the Baobab; the woody shores of Australia to the loftiness of the Eucalyptus; or sunny Italy and the desolate steppes o sia to admire the stateliness of tall fir and pine trees. There are even no yet standing, east of the Mississippi River, which compare well with th massive specimens of giant trees found anywhere; and, though not att the extreme bulk or height of the California Sequoias or the Eucaly New Zealand, are equally wonderful in the massiveness and height of naked trunks and the immense spread of their branches.

The bottom-lands of the Ohio, the Wabash and the Mississippi also at one time in specimens of truly gigantic proportions, and excelled in s large trees of any other locality east of the Mississippi. The best rea can adduce for this fact is the greater productiveness of the soil, while peculiarly sheltered position—being beyond the reach and influence of storms—probably likewise contributed, at least in a measure, to this extr nary growth. In this region, especially the lower Wabash valley, the covered the entire country uninterruptedly. Giant specimens were, so to the rule, not the exception, and very large trees stood in abundance a parently crowded together as closely as they could grow. Even now having furnished fuel, timber and material for saw-mills and sundry other tries, during a period of a century and a half, the larger moiety is still in

ence, which, considering the heavy draft, the energy of a thrifty and energetic people have made upon it during a period of two generations or more, may give us an idea of the great wealth of wood of all descriptions to be found in that district.

We must, however, bear in mind that, after the severe drain upon the arboreal wealth in that region, hardly an acre would now be found which has not suffered more or less as to the character and number of big trees and, in furnishing data, in regard to the dimensions some of the most prominent, we may assert with safety, that these can give but a very inadequate idea of the former grandeur of these primitive forests, long before the stroke of the ax, wielded with the energy of the Anglo-Saxon, the perseverance of the Teuton and the impetuosity of the Celt, had been heard.

The largest tree in North America is, without doubt, the Sycamore, *Platanus Occidentalis*. It is especially met with in rich bottom-lands and is usually found on the banks of streams and on level lands, where the natural drainage is imperfect. A giant of this species has been measured, the trunk of which was sixty-six feet in circumference at the base, which is equivalent to about twenty-one feet in diameter, with a height of two hundred, and a spread of crown from a hundred to a hundred and forty feet! They present a most striking and picturesque appearance, the trunks being of a light yellowish grey and the branches snowy white, contrasting, in a striking manner, particularly when lit up by the sun, with the deep green of the foliage.

A truly magnificent tree, likewise, is the tall and straight Tulip Poplar, *Lyriodendrum Tulipifera*. While ranking second in point of bulk, it probably averaged taller than the Sycamore; but the great usefulness of this tree for lumber—supplying as it did nearly all material for building purposes—has been the cause of the fearful havoc made amongst the finest specimens, some of which are known to have measured thirty-eight feet in circumference with an altitude of more than two hundred feet and a height of trunk of a hundred and twenty feet to the first branches. Such large specimens of the Tulip Poplar, however, are now mostly things of the past, although formerly the prevailing growth in many localities.

The Cottonwood, *Populus Monilifera*, deserves to be ranked among the largest trees of the forest. It grows abundantly on the banks of rivers and bayous and in bottoms. The largest trees of this kind found had attained a circumference of trunk of twenty to twenty-four feet, with a height falling but little short of two hundred feet. The timber, however, is of inferior quality and, cut in planks, is chiefly useful for flooring.

Another species, many magnificent specimens of which are still in existence, is the well-known White Elm, *Ulnus Americana*. Trees of this kind studded with their massive trunks the banks of rivers, streams, bottoms, and low lands. Though never attaining the size of the preceding, they are often fifteen feet in circumference. The White Elm is a very graceful tree. Its widely diffused, pendulous branches float in the air and present a beautiful ap-

pearance, especially when matted. and festooned with the mistletoe, attaches itself by preference to this tree.

The Red or Slippery Elm, *U. Fuloa*, is also a large tree, but does not the size of *U. Americana*. This species furnishes the Elm Bark in pha A small tree, known as the Wahoo or Winged Elm, *U. Alata*, is a so species not found north of lat. 37 deg.

Numerous oaks, growing almost in every locality, also supplied their mens of gigantic proportions. Of these none is more justly celebrated strength, hardness and durability of its wood than the White Oak, *Quercu* which has been known to attain a girth of trunk of twenty feet; with a of one hundred and fifty feet; while the naked trunk sometimes me seventy feet. For most purposes this species is the most valuable. the construction of large water-wheels, nothing can be substituted for Oak, and no wood is so excellent where great strength is desired in beam. For ship-building it is in great repute, and builders will not u other sort of wood for submerged parts, if white oak can be obtained.

Another large tree of the same genus is the Burr-Oak, *Q. Macro* it attains the same girth as *Q. Alba*, but is chiefly remarkable for the r and size of its branches, forming a beautiful and majestic crown, somet hundred and ten feet in diameter with a total height of a hundred and five feet.

The Lyre-leaf, or Overcup Oak, *Q. Lyrata*, likewise belongs to the species; it ranks in size with the Burr-Oak, to which it bears a strong blance. The timber of both is also highly esteemed.

The Water- or Pine-Oak, *Q. Palustris*, also deserves to be ranked w largest. While it attains the same girth of stem as the Burr-Oak, an same total height, the trunk is generally higher.

The Black Oak, *Q. Tinctoria*, is nearly of the same dimensions; it a the same height and spread with a trunk somewhat more slender. G stem, in the largest specimens, twenty feet.

The Red Oak, *Q. Rubra*, likewise known as Spanish Oak, nearly equ Burr Oak in size, but is much more slender, and one of the most graceful symmetrical of the oak family. It is noted for its straight and clear sometimes seventy feet long. Some exceptional specimens measuring ni hundred feet to the first fork.

The Scarlet Oak, *Q. Coccinea*, which may be considered a vari *Q. Tinctoria*, is also a large tree, often acquiring very majestic dimension

The Swamp White Oak, *Q. Bicolor*, as its name sufficiently indic abundant in bottom lands. The largest specimens are found to measure, base of the trunk, fourteen feet in girth, with a height of a hundred and t five feet, and a spread of top of eighty to ninety feet.

In the American forest are also found:

The Chestnut Oak, *Q. Prinus*, a much esteemed timber tree.

The Willow Oak, *Q. Phellos*, a large tree with lanceolate leaves and willow aspect.

The Post Oak, *Q. Obtusiloba*.

The Laurel Oak, *Q. Imbricaria*, attains a girth of seven, and a height of a hundred feet.

One of the most remarkable of this family is the Live Oak, *Q. Virens*, an evergreen species, with leathery leaves. It is regarded as a tree of the first importance for the strength and hardness of its timber, and its value as material in ship-building. It is indigenous in the south, but does not grow to extraordinary dimensions. The trunk is two feet in diameter. This tree seldom exceeds fifty feet in height.

Among the nut-bearing trees we find, likewise, several species of majestic proportions. Amongst these, in size and commercial importance, the Black Walnut, *Juglans Nigra*, stands first. It is, without doubt, one of the most valuable timber trees of this Continent. It grows, withal, to an immense size. Specimens whose trunks measured twelve to fifteen feet in circumference were once quite numerous in certain districts The largest individual of which any record is extant measured twelve feet in diameter of trunk; it was one hundred and fifty feet high, with branches two to four feet in diameter. The numerous industries, for which the valuable black walnut timber is used, have caused so great a demand for it that, were it not for its great abundance, the supply would now be entirely exhausted.

The Butternut, *Juglans Cinerea*, is also a valuable tree. It is highly prized for its beautiful wood, boldly shaded with brown. This kind is much more local in its distribution, and never attains the gigantic proportions of *J. Nigra*. A tree the trunk of which has a circumference of six feet may be considered a fine representative of this genus.

The Shell or Shag-bark Hickory, *Carya Alba*, is a large tree, the trunk of which measures, sometimes, four feet in diameter, with a height of eighty feet to the first branches, and a total elevation of a hundred and fifty to a hundred and seventy-five feet. It is quite abundant in certain localities.

Hardly inferior in size is the Black Hickory, *C. Tomentosa*; it is also common in many districts.

The Thick Shell Bark, *C. Sulcata*; a very similar tree of less size.

The Pig-Nut tree, *C. Glabra*.

The Bitter Hickory, *C. Amara*.

The Pecan tree, *C. Olivæformis*, so highly-prized for its fruit, which is called the Pecan or Illinois nut, is seldom equaled, and never surpassed, by our native trees in appearance. In majestic grandeur it rivals the largest oaks; for gracefulness and spread of top it equals the finest elms, and attains the height of the Sycamore and Poplar. Trees of this kind, upon measurement, were found to have a girth of trunk of twenty-six feet.

The timber of the genus *Carya* is hard, fine-grained, very strong and elastic, but very liable to be attacked by worms.

The White Ash, *Fraxinus Americana*, is a renowned forest tree. It straight and tall, and, under favourable circumstances, attains an eno girth. Some trunks have been found measuring twenty-five feet in circu ence. The timber is white, tough and hard, and in great demand with ca and wagon makers, joiners and turners, and extensively used for bent worl in the manufacturing of household furniture of every description. This s is very abundant.

The Blue Ash, *F. Quadrangulata*, is also a large tree, but does not *F. Americana* in size.

The Red Ash, *F. Pubescens*, resembles *F. Americana*, but is of smaller size. It is found chiefly in moist localities.

The Green Ash, *F. Juglandifolia*, grows in the middle States, and

The Carolina Ash, *F. Caroliniana*, is chiefly met with in the southern

The Red Beech, *Fagus Ferruginea*, is likewise a noted forest-tree, a wood, which is of a redder tint than *F. Sylvatica*, the representative European species in this country, is preferred to that of the latter. Bot common in this country, thrive best in dry situations, and often attain a size. The *F. Ferruginea* forms extensive forests in the north-eastern pa the United States.

The Red Birch, *Betula Nigra*, is commonly found along the ban streams; but it is restricted to certain districts. Some trunks measure feet in girth, with a height of forty feet to the bifurcation of the stem. I duces hard and valuable timber.

The Sweet or Cherry Birch, *Betula Lenta*, is, likewise, a large tree.

The Yellow Birch, *B. Excelsa*. A very stately tree; found in the eastern districts.

The Paper Birch, *B. Papyracea*; also indigenous to the more no districts. This is the species the white bark of which is used by the India the construction of canoes and the manufacture of buckets, boxes and ba Large plates of it are curiously stitched together with the fibrous roots White Spruce, and coated with the resin of the Balm-of-Gilead Fir. birch-wood is converted into an excellent quality of charcoal.

There is still another very important group of trees in our forests. are well and numerously represented by many species. We have referen the genus *Acer*—Maple.

The most noted and useful of the whole family is the Sugar Maple, *Sacharrinum*. It grows to a large size; trees of this species having been with a girth of trunk of no less than fourteen feet. The world-renc maple sugar, which constitutes a staple article of trade, is condensed fro abundant and saccharine juice of this tree. Yet it is equally useful f wood, which is hard, fine-grained, of a beautiful yellowish color and susce of high polish. It is in great demand for the manufacture of articles of ture, and noted for strength and durability. The famous Bird's-eye Mapl

variety of the same species. The Sugar Maple is widely diffused and abundant; it prefers dry localities, but thrives only on rich ground.

The Black Maple, *A. Nigrum*, much resembles *A. Sacharrinum*, and is likewise common.

The Silver Maple, *A. Dasycarpum*, also attains a great size, but is remarkable for the shortness of its trunk; it usually branches at a distance of twelve to fifteen feet from the ground. It makes a splendid crown, however, and attains a height of a hundred feet or more. The wood is not so hard as that of the Sugar-Maple, yet fine-grained and valuable. In rapidity of growth it excels all other kinds.

The Red or Soft Maple, *A. Rubrum*, likewise grows rapidly, but prefers a moist soil and is consequently most frequently met with in bottoms and swamps; it is fully as large as the above species and attains a height of a hundred and ten feet, with a trunk fifteen feet in circumference and sixty to seventy feet high to the first branch. Its wood is good, but inferior to that of the Silver Maple.

The Ash-leaved Maple or Box-Elder, also known under the name of Honey-Maple, *A. Negundo*, attains a fair size and is inclined to grow into a round-headed, low tree, if not crowded.

The Bass-Wood or Linden, *Tilia Americana* or *T. Heterophylia*, often grows to a great size. Trunks twelve to sixteen feet in circumference formerly were not uncommon in favorable locations. It thrives best in bottom-lands, and is often compound, that is: several stems come forth from the same root. The Linden-tree sometimes attains a height of a hundred and twenty-five feet. The wood is white, light and extremely tough, and is used in the construction of musical instruments and for many other useful purposes.

The Chestnut, *Castanea Vesca*, is found only in certain localities. Its wood is very durable when kept dry, is of fair strength and great beauty of grain.

The Buckeye, *Aeseulus Ohiotensis* or *Æ. Glabra*, cannot be regarded as a very large tree, yet some specimens exceed a hundred feet in height. It is not generally diffused. It produces valuable timber, not affected by worms and susceptible of fine finish.

A very remarkable tree is the Honey-Locust, *Gleditschia Triacanthos*. It sometimes grows to a great size, the trunk being forty or fifty feet long and sixteen feet in circumference. Its maximum height is a hundred and forty feet. No wood is at once so hard, heavy, durable and strong. It grows rapidly and prefers a dry, heavy soil. It is found only in certain localities.

The Wild Cherry, *Prunus Scrotina*, was once often met with. At this time, however, but few of the original growth are left. There were formerly specimens of this kind more than a hundred feet high. The wood of the Wild Cherry is of a red color, and in great demand with furniture-manufacturers; it has a fine grain and is easily worked. This species was never very abundant.

The Hackberry or Nettletree, *Celtis Occidentalis*, grows remarkably tall and straight and is a very graceful tree. It is noted for the height of its trunk and

small crown. Trunks seventy or eighty feet clear and ten feet in girth base, were formerly not uncommon. It is found in the Northern and Middle S

The Mississippi Hackberry, sometimes also called Hoop-Ash, *C. Mis piensis*, is a much shorter and more spreading tree, by which, as also by its what dissimilar leaves, it may be easily distinguished from *C. Occidentalis*.

The Mulberry, *Morus Rubra*, is found in many districts, both Ea West, and likewise Southward. It is much hardier than the other repre tives of the same genus, and is therefore preferred for cultivation in some of Europe. The wood is valuable, close-grained, strong, and even adapt ship-building. The maximum dimensions of the mulberry tree are: height, sixty or seventy feet; height of trunk, twenty-five feet; diamet trunk, ten feet.

The Sassafras, *Sassafras Officinale*, though mostly met with as undergr did attain quite a large size and considerable height in some of the W districts. The largest specimens measured, showed a circumference of tr twelve feet and a total height of about a hundred.

The Bald Cypress, *Taxodium Dystichum*, a deciduous species of So climes, is a tree, very large specimens of which were at one time common bottoms and swamps of Louisiana and Florida. Owing to the great dur and tractableness of its timber, however, it has been much sought after corresponding decrease of the finest specimens has been the result. Shi made of cypress, are said to be almost as lasting as slate. Stumps ar found, measuring eight to ten feet across, yet it would be extremely diffi find standing trees approaching these colossal proportions in places accessible.

A lofty and magnificent tree is the Magnolia or Big Laurel, *Ma Grandiflora*. The species of this class are all evergreen, and this one i ticular is conspicuous at a great distance and found in great abundance i South.

The Umbrella Tree, *M. Umbrella*, is met with on the Alleghany M tains and extends as far north as lat. 43°. It has very large, white flower its name is derived from the radiated manner in which the leaves are dep at the extremities of the branches.

The Cucumber-tree, *M. Acuminata*, inhabits the same districts wi *Umbrella*. It is a lofty tree with greenish-yellow flowers.

The Sweet-Bay, Beaver-wood or Laurel Magnolia, *M. Glauca*. Th small tree, fifteen to twenty feet high, with exquisite and fragrant flowers.

Aside from those now enumerated there remains a large class of forest yet to be considered. We speak of the Firs, Pine trees and *Coniferæ* gen which compose large forests in several parts of the United States, and of we shall here enumerate merely the most important.

The Douglas Spruce, *Abias Douglasii*, is a noble tree, attaining a hei two hundred and fifty feet. Immense tracts of forest, chiefly composed o species, are found in the Northwest, from lat. 43° to 52°.

Likewise, in large quantities: the White Spruce, *A. Alba*; the Red Spruce, *A. Rubra*, and the Black Spruce, *A. Nigra*, trees of lesser growth.

The Hemlock Spruce, *A. Canadensis*, not much esteemed on account of its crooked grain and coarse fibre.

The Balm-of-Gilead Fir, *A. Balsamea*, found from Virginia to Canada. The wood of this species is likewise of small value, but it yields Canada balsam.

The Red or Canadian Pine, *Pinus Canadensis*, is found in some of the northern districts. This is the Yellow Pine of Canada and Nova Scotia. The wood is valuable for ship-timber and masts.

The Northern Scrub or Grey Pine, *Pinus Banksiana*, interesting merely as an Arctic species, seldom attaining ten feet in height and extending from lat. 43° farther north than any other species of pine.

The Yellow Pine, *P. Variabilis* or *P. Mitis*, very valuable and extensively used in ship-building. This species grows to a height of eighty feet, with a diameter of fifteen to eighteen inches. It is largely exported to England.

The Jersey Pine, *P. Inops*, a small tree, abounds in the lower part of New Jersey, and thence to the south-west. Great quantities of tar are made from it in Kentucky.

The Pitch Pine, *P. Rigida*, a native of the Northern and Middle States, growing principally on uplands, and attaining a height of seventy to a hundred feet, and a diameter of trunk of two to two and a half feet. Tar and lamp-black are sometimes made from it; but it is mostly used for fuel.

The Loblolly or Old-Field Pine, *T. Tæda*, grows on dry, sandy soils, in the lower parts of the Southern States, often occupying lands exhausted by cultivation. Vast tracts in the South called pine-barrens, are composed almost exclusively of this species. It has a wide-spreading crown, and sometimes attains a height of one hundred feet. The timber is of no great value.

The Long-Leaved or Southern Pine, *P. Palustris* or *P. Australis*, is one of the most important of North American forest trees. It furnishes us with the greater part of tar, resin, pitch and turpentine used in this country. The timber also is in great demand, and extensively made use of in the construction of water craft. The trees attain a height of seventy to ninety feet, with a diameter of trunk of sixteen to twenty inches.

One of the most valuable of American forest trees is the White Pine, *P. Strobus*, which often grows to a height of a hundred and fifty feet, the trunk attaining a diameter of five feet and upward.

Several other species of the genus *Pinus* are found in the north-west, and species of Larch, *Laris*, a sub-genus of *Pinus*, are to be met with in extensive tracts, on the Alleghany Mountains.

We have the Red American Larch, *Larix Microcarpa*, a noble tree very numerously represented, and

The Pendulous or Black American Larch, *L. Americana*, a very fine species with larger leaves.

The well-known Virginian or Red Cedar, *Juniperus Virginiana*, is from Lake Champlain to the Gulf of Mexico. It grows to the height o feet. The heart-wood is of a beautiful red color, and highly valued by t and coopers. It is very durable, and extensively used in the manufac pencils, handles of paint brushes, etc.

The White Cypress or White Cedar, *Cypressus Thyoides*. Grows medium size. Prefers low, swampy places. The wood is much used for posts and telegraph poles; it is, however, lighter and less durable than *erus Virginiana*.

Besides the several genera and species, enumerated above and consi in too cursory a manner, hundreds of others, either congeners to those s of or constituting intermediate or entirely distinct and independent fami the vegetable kingdom, are found in our forests. Many, among them rank with the lofty and stately forest productions, while others appear more humble situation of undergrowth and copsewood. While some loc produce certain families or single species, to the exclusion of nearly all o many regions present to our view a scene of the most diversified veget Deciduous trees and evergreens, large trees and undergrowth, species o most striking dissimilarity, all being mingled together in one heterogenous and presenting to our view the most varied—and hence the most picturesc combinations possible.

It is self-evident that the degree of thrift and luxuriance in forest v tion must depend, in a great measure, upon the nature and productiven the soil. But it does not follow that *all* trees invariably thrive best in ri for there are species for the existence of which a poor, sandy or gravell nay, even a bare rock, appears to be a necessity. Many of the *Conifer* least, absolutely prefer locations manifestly unfit for almost all other Which on the contrary carry out the principle as above laid down, viz: ing with great rapidity and in the most luxuriant manner, and attaining proportions, where a superabundance of nourishment is furnished by M Earth, but dragging out an almost stagnant existence, or at least slowly in ing and becoming decrepit and dying of old age, before having attained half of the size or stature usual in more favorable spots, should their lot h where a poor soil hardly affords the scantiest sustenance to a pining and dy vegetation.

But aside from fertility or sterility of soil, there are other circums which may be favorable or unfavorable to the development of growth. are aridity or moisture, exposure or shelter, an open or shaded posit greater or lesser elevation, the influence of sea and lake winds, exposure effects of great heat in summer, or of severe frosts in winter, and many causes, either special or general, natural or accidental, which may reta accelerate the growth of trees. What in many instances would prove f one kind, may prove highly beneficial to another, in accordance with different natures and requirements. On the rocky crag, exposed to th

violence of winds and storms, where a small deciduous shrub would hardly find soil sufficient to strike root, Firs and Cedars will attach themselves with ease, insinuate their searching roots into the crevices of inhospitable rocks, grow thriftily, and become large trees. Again, Cypresses and Elms will thrive luxuriantly in swamps, where acorns or nuts would invariably be drowned. Or, while we look for Poplar, Willow, Ash or Linden, in the valley, we have to mount the neighboring mountains to the very regions of perpetual snow, to find the Spruce, Pine or Larch, passing, as we ascend, the majestic Oak, the Beech and Birch, which thrive best on the mountain slope.

The forest has ever offered numerous and varied sources of enjoyment to the enthusiastic lover and admirer of nature. That it presents at the same time an inexhaustible field for improvement and enlargement of views to the earnest and devoted student, no one who has ever trod the path of natural investigation and research will deny. For in the field of science wonders meet us at every step, and as we advance, new beauties are continually presenting themselves to our view, and the investigation of nature becomes a source of unalloyed pleasure.

No one who has wandered much in a forest region can have failed to perceive and enjoy the delicious fragrance emanating from the aromatic foliage and resinous wood, when the cool air of evening develops the exhalations from the still and warm vegetation. The aromatic odor of trees, shrubs and plants, as it sweeps over the hill-tops or lingers in the valley, greets our nostrils, and all our senses are agreeably affected.

Let us consider, from a mountainous elevation, the fertile valley through which the clear stream takes its meandering course. It disappears yonder behind the projecting cliff, but comes to view again in the distance, like a silvery thread. Its banks are studded by stately elms, in all the beauty of natural perfection, grand, graceful and symmetrical, planted there by the Almighty hand of Him who "doeth all things well." We stand enraptured, viewing the beauties of the distant forest as the reality of form and color gradually melt away in the vapory space, bathed in the bright and charming hues of the rising sun. Our minds gradually ascend from Nature to Nature's God, and our hearts are aglow with the liveliest emotions of admiration and gratitude.

Likewise, penetrating the recesses of the sombre forest, we may consider the majestic grandeur of the stately oaks; their weather-beaten trunks pointing heavenward; their gnarled and massive branches spreading in a thousand fantastic forms, and crowned with a wealth of picturesque foliage. The sunlight, mostly obstructed, finds its way, here and there, through interlacing boughs, imparting its own brilliancy to the shining leaves; at the same time making the tints of the luxuriant foliage its own, and falling, in richest hues of golden green, on the branches, trunks, and mossy carpet beneath.

Here we behold the most startling effects of light and shade; here we may view nature in its full and undisputed glory; while to the true Christian everything, large or small, speaks of an Almighty, Benign and Infinite Creator, whose

every work is harmony and perfection, and who has imparted to every ol degree of beauty and comeliness, a faint glimmer of that Infinite and P Beauty which is one of the Divine attributes.

The forest has always furnished inspiring themes to poets and pai No wonder they loved to sing the ever varying beauties of sylvan scener charms of the wooded dell, the quiet and repose experienced in the dep the forest; no wonder the bards of old, enraptured by similar beauties, s tune their harps in concert with nature, and depict in lays and rhym grandeur, beauty, and the manifold charms their poetic souls tasted i depths of the enchanting forest.

No wonder that painters loved to dip their brush in the glowing ti the golden light, as it stole through the foliage, and that they dwelt with r on the sombre recesses of the leafy glen. Landscape painters of every ag clime feel themselves drawn, as by enchantment, to the solitude of the there to study the infinite variety of forms as presented in trunks and bran the ever-changing effects of light and shade, as the hour advances; the contrasts produced by the powerful rays of the orb of day, shining in unb lustre from the azure firmament; or the mellow lights and the nearly impa effects of ærial perspective, when clouds darken the sky. It was by thus s ing nature's mystic charms and penetrating into the arcana of harmony in ing, that they learned to portray with admirable truth, the shadowy bougl kisses, in sweet dalliance, the cool surface of the rippling brook, and vie nature herself in representing the mist of the wooded valley as it partiall closed the tree-tops of the sun-lit forest beyond. It was in the forest learned to perpetuate on canvas the moss-covered trunk of the sturdy oa age of which is counted by centuries, the whitish stem of the ancient an brageous beech or the pensile and graceful branches of the spreading elm is held in close embrace by the ivy, or is matted over by the emblematic m toe. It was here they studied and sketched the wonderful effects in the waters of the forest stream, as it mirrored the shrubs and plants on its ba refracted the dazzling white of the clouds. Here it was, no doubt, th massive trunks, the majestic sweep of the large bending branches, and the leafy canopy above, inspired the architects and builders of old, to erect magnificent gothic structures, destined to the worship of the Creator; su ing them with a great number of massive columns to represent the tr placing on their elaborate capitals a number of beautifully-wrought ar spreading in all directions like branches; enclosing the edifice with va ceilings, imitating in this a canopy of foliage, and thus producing struc which to-day excite the wonder of the modern architect and the admir of every lover of the beautiful.

Nothing can surpass the loveliness, charm and grace of Spring i forest. Trees and shrubs gradually revive from their wintry stupor. boughs and twigs, which stood so long denuded and as dead, are swelli every bud. Tiny leaves make their appearance under the mild and in

rating warmth of the vernal sun. The nascent foliage, of tender green, is yet so small that it hides not the distance, but throws, as it were, a semi-transparent film of softest hue over the sylvan scenery. Gentle zephyrs rustle and sigh softly through the thicket, which is alive with feathered songsters of various colors, joining in beautiful song to enhance the charm and beauty of spring. Robins, thrushes and warblers are busy meanwhile building downy homes for their future offspring, and the cheery call of the quail is heard in the distance. Bright spring flowers meet our eyes everywhere, among the new grasses by the road-side, and everything betokens life, vigor and enjoyment.

But the foliage has now acquired its full growth. Deep, fresh greens of various shades have superseded the light, transparent tints of spring. The luxuriant foliage effectually shuts out the burning rays of the sun, and cool, shady bowers afford a safe retreat from the oppressive heat. The inviting shelter under the forest trees renders the temptation to recline at full length on the grassy carpet and enjoy quiet repose, almost irresistible. The nest of the oriole is seen rocking at the end of an elm—or poplar—branch. Our little songsters are hushed; they must now perform more serious duties; an interesting and hungry family is dependent upon them, and they are busily engaged looking for worms, larvæ and insects to quiet their noisy little ones. Now and then a scarlet tanager, an oriole or cardinal gros-beak, in gorgeous livery, is seen flitting through the dark foliage, or a nuthatch silently moving up and down the stem of a neighboring tree.

The scene is again changed. Nature is clad in different robes. She has donned her splendid autumnal attire. Every tree is aglow with the richest tints of gold, emerald and ruby. The sun shines more freely through the branches, already relieved in part of their foliage. The forest is gorgeous with splendor. Light breezes rustle through the tree-tops and golden leaves are falling one by one. Magnificent as is the scene, nothing reminds us more forcibly of the instability of every enjoyment here below. Most of our little feathered friends have already departed for other climes in anticipation of the cold and bleak days to come. Others are silent, except the vociferous blue jay, who sounds the warning note in curious and discordant tones. The monotonous cawing of the raven or rook is heard in the distance. Squirrels are busy gathering their winter store of nuts and acorns. From day to day the aspect of the forest becomes dimmer. Sober browns and dull greys gradually assume universal sway, and the trees, stripped of their foliage at last, present a scene of universal desolation.

Winter has now come. Cold winds sigh and moan through the bare branches or rustle ominously through the swaying tops of firs and pines. The larger boughs here and there produce creaking, jarring sounds as they chafe or clash together, moved by gusts of the powerful north wind, and everything is calculated to dispose us to serious and melancholy thoughts. Nearly all the little denizens of the air, which were wont to enliven the scene, have fled before the approach of winter or have retired to the dense thicket. Others

have taken up their winter abode in the neighborhood of the barn or house.

Yet, even during the bleak days of winter, the forest is not entirely of beauty. When the dazzling snow covers every tree and branch, h in broad masses on the drooping boughs of fir or pine, it imparts to the landscape an element of great interest to the admirer of winter scenery. spotless whiteness of the snow produces many remarkable effects as it c strongly with the dark tints of boughs and trunks, or mingles, in the di through gradations of softest blue or faintest grey, with the dull and hues of the snow-clouds; or, when they, separating, no longer hide the sun, and the shining rays of the great luminary fall on the dazzling snow, object glitters as if studded with diamonds. The scene then is, indeed, beauty.

Or, should old Boreas, during a pelting rain, suddenly act on the cl and convert into crystal the myriads of rain-drops, as they fall on the le then every twig becomes enveloped in sleet, and large boughs soon dro under the accumulated weight of ice; as that weight increases the boughs give way one by one, and the forest re-echoes the crashing so falling trees and branches. The wintry orb again shines forth in undim splendor and his rays are refracted in the glittering coating which en every object. Every twig and branch is studded, as it were, with miniatu and the entire scene becomes one of transcendent glory and beauty.

Extremely transient, however, this beauteous scene is doomed to be. sun asserts his power. Little by little the icy coatings loose their close upon twig and branch and fall to the ground. The splendor of the gradually lessens, and, a strong wind springing up, in a few moments ob the last vestige of all this magnificence, and the forest returns agai wonted stillness of wintry gloom.

The forest is like an immense book ever open for our instructi enjoyment; and not only during the day, but likewise in the twilight of ev or, still better, when the pale moon sheds her soft and mysterious radianc we read one of its pages and admire the fanciful effects produced by that light in the depths of the forest. As the pale moonlight creeps thro branches, and reaches the white trunks of beech, poplar, or birch, delin on them the shadow of overhanging boughs, these white objects stand bold relief against the masses of impenetrable darkness beyond, and pre our imaginations all manner of fantastic, grotesque, and weird forms. A ghost-story, the thrilling narrative of many an apparition, owes its ori doubt, to these effects so very natural it is true, yet so eminently cal to unsettle the nerves of timid persons. Nor are the natural gloom and o sive stillness of the forest—unbroken save perhaps by the occasional hoot the owl—joined to the dread of the nightly hour, adapted to allay their gr less apprehensions. Be this as it may, a lively imagination could easily c up from such appearances—the natural cause of which can often be ba

tially understood—many apparitions which would at least equal in general probability some of the best authenticated visions of supernatural appearances extant.

What influence the presence or absence of forests in different countries may have had and still has on the origin, continuance or modification of popular superstitions, regarding elves, sprites, gnomes, fairies and similar productions of untutored minds—might prove a question of sufficient importance for studious inquiry to the philosopher and psychologist.

The early settlers of this country must have admired as well as we do the numerous and manifold beauties afforded by the forest. They too must have been awed by the grandeur and melancholy gloom of the primeval forest. They, particularly, must have been struck with wonder at the majestic size and loftiness of the trees and the luxuriant growth and abundance of vegetation. They must have loved to roam through that immense expanse of forest, and been delighted with the manifold beauties displayed by sun-light and shadow, the change of the seasons and the abundance of game of all kinds which the forest afforded. They must have tracked the fleet deer as they fled in herds before the deadly musket of the hardy pioneers, and no doubt often shot the wild turkey as it answered to the treacherous and fictitious call of the hidden hunter. Yet the soil, overshadowed by the noble monarchs of the forest, was to become the means of subsistence for thousands. These same trees were to furnish the material for the construction of their ponderous, yet comfortable log-cabins, and likewise to supply the fuel wherewith to mitigate the rigors of winter. It became necessary, therefore, to fell the stately trees, to remove the extensive and efficient canopies which prevented the beneficent and vivifying rays of the sun to penetrate and warm up the bosom of mother earth in order that husbandry might henceforth flourish and the virgin soil produce the sustenance necessary to civilized man.

The forest, moreover, soon became to them a source of disquietude and fear. They soon learned that it was the haunt of numerous wild beasts that would attack them or lie in wait for their flocks, and that it afforded, as they found, but too often to their cost, a lurking place for bands of hostile Indians, who might at any time make a raid upon the small, weak and ill-protected settlement and destroy, by tomahawk and torch, alike the happiness of their homes and their material wealth, the fruits of untold hardship and almost superhuman toil.

No wonder, then, that the shady retreat of the woody glen soon lost all its charms and that the love for the picturesque and poetical was soon stifled in every breast, by the necessity of the hour, and that a war of extermination was declared against the trees.

The early settlers who were thus bent on destroying, in the most thorough and expeditious manner, the trees which in truth could have been called their great rivals in the possession of the soil, had and could have but one object, namely: to get rid of them with the greatest possible dispatch. To them, trees

in themselves, however straight and tall or of whatever kind of woo valueless, except in as far as they represented a certain amount of la stowed on them, to render them available as building material or for fu as the extremely limited demand stood in an inverse ratio to the immense in every spot, we may easily conceive how little domestic economy cou tribute to modify the wholesale destruction and devastation of forests upon everywhere.

The slow but sure process of the woodman's ax soon told by many opening in the forest. Many a cultivated field, though limited in exte foreboded the change that succeeding decades of years were to bring r in the aspect, but likewise in the very nature of the country. Well w have been, indeed, had the process of clearing advanced at a much slow and had the sturdy pioneers been content with dividing the possessior soil with the monarchs of the primeval forest. But was a nascent pow to assert itself against an existing one, ever content to arrest its onward when a degree of equality had been obtained? No, never. Thus, also case: from the clean work of the ax appeal was taken to that most dest of all elements, fire, and the ax was henceforth, in hundreds of instance merely to facilitate wholesale combustion, or to finish what the dev element might have spared.

Long after the immediate necessity of acquiring more arable s ceased in many regions; long after the last hostile redskin had turned h toward the setting sun, and forever departed, the wild beasts of the having been all exterminated, or compelled to migrate to abodes an more congenial to their savage natures, the fell stroke of the ax, at eve ceeding winter, told of farther destruction of the forest. But the moti gradually changed, timber and firewood had acquired a value. Ship- bridge-timber, material for all kinds of industries, began not only to ready market, but exportation of the more valuable timber, an ever-in home demand, and the consequent increase of prices, excited the cup the owners of woodland—many of whom rested not until the last tree, immediate value whatever, had been laid low, and their entire prope been literally denuded of trees.

We have now come to a period when the devastation of American is assuming rapid, nay, alarming strides. The destruction of our pine f proceeding at an ever accelerating rate, well calculated to inspire apprel to any one who will take the important subject under careful consid The timber in Maine, wherever accessible, is nearly exhausted, and the generation will probably witness the total denudation of the extensive p of Michigan and Wisconsin. The consumption of pine-timber in Penns is steadily approaching a period of utter exhaustion, and her mounta nearly disrobed of her giant wild pines and hemlocks.

And how is it with the destruction of deciduous woods? Everywh same report of fearful havoc, ruthless destruction, and almost incredibl

lessness. The destruction of thousands of acres of valuable woodland, as a natural consequence of the ever increasing demand for fuel, railway ties, and timber for every considerable form of industry, and manifold purposes of manufacture, fatal as it was to the preservation of forests, was at least based upon the exigencies of legitimate consumption, and the necessities of improvement. But what shall we say of the wantonness wherewith so many splendid specimens of arboreal grandeur were laid low for no purpose whatever, unless it were to enjoy the crash of the falling giant as it came thundering through the other trees, or mayhap to secure the possession of an unlucky "'coon" or "'possum" which had found refuge in its hospitable branches? Thus the growth of several centuries was destroyed in an hour, and a noble tree that, in less than twenty years, would have been highly prized as capable of furnishing firewood for a whole year, or supplying lumber enough to build a comfortable home for an entire family, was doomed to slow and ignominious decay, and also preventing or retarding the growth of seedlings which were once destined to thrive in its beneficent and protecting shadow, and in after times to take the place of the parent tree. Considering this subject from whatever standpoint we may we cannot but deplore this wholesale and, in many cases, needless destruction of forest trees.

The extraordinary demand for choice timber has caused the culling over of large tracts of forests, and the cutting down of every valuable tree found. It needs little penetration to appreciate the irreparable injury inflicted in this manner, aside from the ruinous depreciation caused to such forests. For aside from the actual value of the timber thus removed there is another evil attached to this policy, namely, the destruction of many saplings, valuable chiefly for the future, either crushed by the falling timber or cut down to facilitate its removal. The freer access given to both the effects of heat and cold likewise operates disastrously upon the remaining trees. That this is no idle theory any one willing to verify it can ascertain by observing the condition of the forest trees in the vicinity of clearings. It will at once be noticed—perhaps with some surprise—how many trees in similarly exposed localities have died or are gradually pining away.

A great number of large trees in our forests, especially the oaks, are also noticed dying at the tops. This is so general that in some localities it would be extremely difficult to find even a small percentage of sound white oak trees two feet in diameter. The reasons for this untimely decay are various. Some of them may be assigned without difficulty.

The soil of the virgin forest was no doubt very spongy, and consequently less liable to extremes of heat, cold, and drouth, than that which is treeless. There had been for ages an accumulation of decayed vegetable matter, consisting of the yearly leaf-crop, the decay of fallen branches, and of successive generations of trees themselves. This rendered the upper layers of the soil exceedingly rich in plant-food, and the trees of a more recent period had their root system very near the surface. Many genera now exist which habitually spread their

roots in the upper layers of the soil, and consequently within the im
influence of the air. When forests become subject to man, and are s
as pasture for cattle and sheep, the underbrush and small seedlings are
off or grubbed out to make room for grass; the leaves, rotten logs and b
in a word everything that was calculated to ward off the direct rays of
or modify the extreme effects of cold, is worked into heaps and bur
saplings and smaller growth are cut out to give way to more pastur
natural and inevitable consequence of all this is a notable change in t
perature of the forest soil. The constant and almost uniform humidity
upper layers gradually comes to an end by the free admission of wind a
light, and the soil becomes more compact. The rain no longer freely pe
The water necessary to the moisture and health of the upper roots
rapidly. The cattle contribute their part to the general injury in mak
upper soil more and more compact and heavy by continual tramping.
of the mellow compost of decayed wood and leaves we have a natu
often artificial grass-crop, which appropriates the remaining nourishmen
fibrous and delicate feeders of the root system, and, as a natural conse
the premature decay of many of our noblest forest trees inevitably follo

The devastation of forests which, of late, has taken such appalling
tions, gives rise to serious apprehension regarding the future. Pr
however, the present generation will not live to witness the extreme de
firewood which is sure to follow the unprecedented and wasteful consu
it has reached at present. Yet the ultimate extinction of all large t
forest is a matter of certainty, and the approximate period may e
established by the data of actual yearly consumption and of probable
But aside from producing wood, the utility of which is so extensive an
fold, the forests are of vast importance as they stand. The area of the
now in existence is computed to cover scarcely one-tenth of the earth's
The insignificance of this area, as compared with that not covered l
would justify us in the belief that forests exert only a slight influence
general climate of the globe. Be this as it may, the results noted, si
denudation of extensive tracts, go far to demonstrate that forests po
affect local climates. Trees exert an influence which induces the preci
of rain. The soil of the forest, as has been observed above is, by
nature, capable of retaining a great quantity of moisture. The gradual
ration, taking place in hot weather, tends to cool the atmosphere. Tree
selves, meanwhile, are also evaporating vast quantities of water, which t
constantly absorbing from the soil. This absorbing process itself likewi
to cool and moisten the air. Now, if trees are, in summer, constantly r
ing the air and lowering its temperature, they must determine the preci
of rain from any passing current of air at a certain temperature.

The attention of learned men in this country, as well as in Eur
been directed to the undeniable fact that during a certain number o
there has been a steady diminution in the waters of the Danube and oth

rivers of Europe, especially since the practice of felling forests has become common. In order to fully investigate this subject as well as all meteorological phenomena in relation to it, and thus to arrive at reliable data, commissions of learned men have been appointed in several countries. The prime cause, however, of this gradual decrease of water is generally conceded to be the destruction of forests.

During a conversation lately, on this subject, with a gentleman residing in this vicinity, a native of the Netherlands, identical facts were observed by him. During a visit to his native country, a few months ago, he remarked that he was amazed at the extremely low stage of water in some of the principal rivers. The Meuse, on the banks of which he had resided to his fortieth year, appeared to him, after an absence of twenty-five years, a mere shadow of its former self. Ordinary river-vessels were obliged to wait for the tide before being able, aided by lighters, to pass the shallow places. He was then informed that the water in this river was steadily decreasing from year to year.

Similar effects have been observed in our own country. In many places we find that what once were important mill-streams now furnish a mere thread of water, save when filled with sudden freshets. In this state streams emptying into the lake, which once were navigable, will not now float a canoe.

But here might be asked: How does this universal complaint of deterioration of water-courses and drying-up of streams agree with the reports of fearful devastation of property and loss of life caused by sudden inundations in France and elsewhere? We say perfectly, and proceed, at once, to trace these catastrophes to the same cause, namely, the general cutting down of forests. Let us suppose a hilly country covered with forest vegetation; a heavy and long-continued rain falls. The porous and spongy soil absorbs an immense quantity of water. The leaves, twigs and branches cause obstructions which retard the flow of water towards the ravines and forest-streams. The trees themselves, especially by their foliage, retain a certain quantity of water. The natural elevations and ridges formed by the spreading surface-roots create many basins of diverse capacity which all hold their modicum of water. The result of all this is that perhaps not one-half of the actual rainfall finds its way directly into the large channels; while of the other an appreciable quantity arrives after the lapse of some time, thereby affording the rivers a means of disgorging the water nearly as fast as it accumulates from the feeding streams, brooks and rivulets.

Let us now imagine, by way of contrast, a country identical with the above as to its topographical features, but denuded and under cultivation. Suppose, moreover, an equal quantity of rain in the same time. Mark the difference. The water immediately collects in the ditches, thence it rapidly flows into the ravines, which are quickly converted into swiftly running torrents, pouring great quantities of water into the mountain-streams which, in a short time assuming the proportions of mighty rivers, cause the main stream to rise with incredible rapidity, overflow its banks, and its angry waters to reduce in a few

hours fertile valleys to desolate wastes, and villages and towns to ru desolation.

The same quantity of water which in one case would have been r and so permeated to the subsoil supplying the water-bearing strata, copious perennial springs, and affording fertility to the soil, freshness a dure to the valleys, drink to man and beast, even during periods o continued drought; in the other case flows unimpeded and unchecked low-lands, acquiring greater impetus as it increases in volume, causin destruction, finally finding its way into the ocean, leaving in its track but desolation, followed by extreme aridity.

The question here is pertinent, whether the converting of a propo the cultivated soil into tracts of young forests, of moderate extent, wo so improve the local climate, regulate the rainfall and afford shelter aga piercing winds of winter; that a greater degree of productiveness, t with a reasonable safeguard against the failure of crops by extremes of d heat and cold, could be obtained for that portion set aside for the ra farm and garden products. Meanwhile, there remains no doubt that t dition of many districts, now devoid of timber, could be much improv judicious and general setting out of young trees by the road-side, an fences and water-courses. Thousands of young trees could be made either in entirely unproductive spots, or by their shadow and shelter i the condition and fertility of other localities. Although the present ger could not expect to reap the full benefit of artificial forest-growth, many advantages of various import would no doubt accrue from such a course

The utter extinction of the original American forest appears inc If it be not in our power to save what yet remains, let us so far for egotistical views as to be willing in this respect, at least, to toil, pl water, that others after us may reap and enjoy.

[The following note explains itself—the statement was made up was considered good authority and well vouched for.—ED.]

To the Editor of the Scientific Monthly:

DEAR SIR,—An item in the first number of the MONTHLY has jus to my notice, announcing the discovery of a bed of "Corundum," in County, Michigan. The news is quite too good to be true. The rocks southern peninsula are wholly sedimentary, and covered almost ever with drift material and alluvium. Hence such a discovery would be a s one to geologists. I have seen some of the so-called corundum, which for a polishing powder, and find it simply pulverulent carbonate of lime deposit in question is, therefore, one of calcareous marl. As your journ to be authority in matters of science, I have thought it right to mak statements.

Yours truly,

DETROIT, Mich. A. B. LYONS,

WEATHER.

As it is just possible that the word weather may not convey to everybody the same idea, and that different persons may attach somewhat different meanings to it, it will perhaps be useful to begin by indicating the sense in which we are going to use it here. That sense, however, can scarcely be determined by direct definition, for, if Webster is correct in saying that a definition is "a description of a thing by its properties," it follows that it can only be applied to things which possess properties. Weather, therefore, can never become the subject of a definition, for its essential character is to be always changing, and, consequently, to have no fixed properties at all. When, then, we learn, from another grave authority, that weather is "the state or condition of the atmosphere with respect to heat, cold, or dryness, moisture, wind, rain, snow, and fogs," we may, if we are satisfied with the phrase, admit it as a general and approximate statement on the subject; but we cannot, certainly, accept it as possessing the qualities of a definition, and even as a mere statement it is incomplete, for it makes no mention of shade, sunlight, hail, dew, and rainbows all of which are incontestably elements of weather.

But, if we cannot establish a definition, we can arrive at the same end by following out a distinction. By determining the differences between weather and climate, by sorting out to each of them its own share of their seemingly somewhat intermingled rights, we shall finally attain a complete view of weather by itself.

Climate is, in the general acceptation of the word, a settled condition; while weather is the most uncertain, the most fluctuating of our surroundings. Climate rests on certain recognized bases; weather shifts about with accidents. Climate depends on distance from the equator, on height, on the formation and exposition of the soil, on the degree of purity of the atmosphere, on proximity to or distance from the sea, on the action of man through cultivation; but weather is, to a great extent, at least, independent of all these influences.

Weather is, essentially, the disturber of climate; it improves it or it spoils it from day to day; it is, consequently, a part of it, but a part of it as health and disease are parts of our bodies. Climate is geographically fixed, while weather is atmospherically variable; climate is a calculated quantity, while weather is an unknown one. All sorts of rules are applicable to climate, but none are applicable to weather. Climate is monarchy; weather is anarchy. Climate is a constitutional government, whose organization we see and understand; latitude and altitude are its king and queen; dryness and dampness are its two houses of parliament; animal and vegetable products are its subjects; and the isothermal lines are its newspapers; but weather is a red-hot radical republic, all excitement and uncertainties, a despiser of old rules, a hater of proprieties and order. Climate is a great stately sovereign, whose will determines the whole character of the lives and habits of his retainers, but whose rule is regular, and is therefore so little felt that it seems like liberty; but

weather is a capricious, cruel tyrant, who changes his decrees each d who forces us, by his ever-varying whims, to remember that we are Climate is local; weather is universal. We are indifferent to climate l we are accustomed to it, but we are dependent on weather because w know what form it will take to-morrow. Climate is the rule; weather exception. Climate is dignity; weather is impudence.

If these comparisons are admitted as exact, it ceases to be impos bestow a name on weather; there is a certain modern locution which s have been made expressly to designate it; weather is a "girl of the Like that conventional young person, it is impertinent, imperious, and able; like her it is often brilliant, but easily bad-tempered; like her it and gay by turns, with no avowable reason for being either; like her it noisily; like her it holds its tongue lazily, or talks loud impetuously; l it is, on the whole, a mistake. Whichever way we look at it, we find it objections. Socially, it is what the novels of the last generation used t heartless coquette," who tempts, stimulates, and lures, and who sets th possible example to her neighbors. Morally, it is both a deceiver and a thrift, whose conduct would humiliate and pain its ancestors, if it h Intellectually, it may be described as an idiot, for its actions are the cons of no recognizable motives whatever. And yet, with all these unmis defects, it exercises an all-pervading power over every fruit of nature, fr to mushrooms. Indeed, poor nature, (which, by the way, as Voltaire o is most wrongly named, for she is in reality all art, and not nature a poor nature must sometimes feel that, in creating weather, she has herself with an intolerable master, who wilfully ill-treats both her offspring, and spoils irrascibly a good deal of her prettiest and brightes work. It would, however, be altogether useless to ask her why she has singularly foolish as to permit weather to exist at all, for she never inquisitive questions of that kind; and perhaps, even does not know w answers are. Her ignorance, indeed, is possibly as great as that of itself; and, in fact, she proclaimed that it really is so when she ma remarkable confession to the curious philosopher, saying to him, "I an earth, fire, air, metal, mineral, stone, vegetable, animal. I feel that I l intelligence within me; you have one, too, but you cannot see it. I car mine, either; I feel it, but I cannot measure it. Why then do you, who a small part of myself, desire to know what I do not know?" Weath the same situation.

And now, as we have, in this way, obtained a general idea of what w by weather, and as we are not likely to learn much more about the reason of things by pausing for a reply, we may as well go on to the calities of the question.

Weather includes every modification of the atmosphere by wh organs are sensibly affected. Each one of its agents is a power by itsel ing a special action of its own upon us, but resembling all its fellows

common characteristic of capriciousness and instability. Its influence, in some shape or other, is unceasing, for it works upon us through the air, which of all the details of creation is the one with which we are in the most intimate relations. And yet, though almost every other form of matter has become, in some manner or degree, subjected to our will, and can be directed, modified, or used by us, more or less, as we like, how we like, and when we like, the air remains mercilessly our master; it imposes itself on us, according to its own fancies only, everywhere and always, sleeping or waking. We cannot do without it, but we can in no way control it; life, heat and sound come to us through it alone; without it we could neither hear, nor be warm, nor breathe; without it we could neither smell the flowers nor listen to the birds. Our food depends upon it, for abundance or starvation are its children, and, finally, we ourselves are materially composed of it, for we, and all the animals and vegetables around us, are in reality, as Thales wisely said, made up of condensed woven air. But yet, notwithstanding all these relationships, the atmosphere keeps us off at arm's-length and will not permit us to use it in any ways but its own. This is vexing, but nothing whatever is to be gained by losing our temper about it; it would be altogether futile to imitate Voltaire, and to scornfully call the air "a blue and white heap of exhalations;" that would in no way help us. It is just as well to be polite, in spite of the annoyance we may feel at the attitude of contemptuous mastery which the atmosphere assumes towards us.

It was observed just now that weather has no visible motives for its actions, and that it therefore merits to be called an idiot. But, though it has no motives, it has causes; like a bucket which goes up and down in a well, it has no will of its own, but it obeys impulses which it cannot resist. The causes are somewhat various, and are even, occasionally, conflicting; but yet they all have one common origin, they all result mainly from the fact that the atmosphere rests on a mixed floor. If all the air reposed exclusively on water or on earth alone, there would be no weather; of course there would be climates, but they probably would be very nearly free from accidents or changes, for the reason that no sufficient agent would be at work to upset their regularity as weather does. It is the division of the earth into sea and land, it is the joint, though separate, action on the atmosphere of those two bases, which create weather; it is the counter working of those two pavements on the air above them which provokes its good or bad behavior; it is the contrast and the clashing between evaporation and precipitation; between the uplifting and the downpouring of the waters, according to the variety of topographic influences, which bring about the wild uncertainties of weather, and destroy the peaceful unities of climate. It is, however, not solely because the surface of the earth is a mixture of wet and dry that these incongruities arise; the varied nature, and the diversified disposition of the materials of which the land part of that surface is composed, must also be taken into account; for, as through their agency the distribution of heat on land is rendered most uneven, the atmosphere in contact with that land is irregularly heated also; its faculty of absorbing vapor increases or

diminishes with its temperature, and, in this way, a second motive ca
weather is produced. It is, however, altogether insufficient and discourte
make our first allusion to vapor in this casual, incidental sort of way.
is the primitive form of all the visible elements of weather; it is the fo
which supplies all downfalls on to earth, whatever be the shape they
without it there would be no clouds, no rain, no snow, no dew, no moist
any kind at all. It is the common mother of the race of wet; it is the e
of all the forms which liquid can assume. It is everywhere around us;
depends upon it; without it neither birth nor growth are possible; with
all England would be ruined to-night, for there would be no more steam.
this special homage to its merits and its value, we can now proceed w
consciousness of duty discharged.

The next thing to be observed is that as the evaporation, which s
vapor, is a process brought about by the action of the sun, which a
exercised in a very tangled and untidy fashion, we find in its uncertainti
third great spring of weather. The power and vigor of that action d
firstly, on the proportion of the substances of which the atmosphere i
posed, for, though the composition of air, properly so-called, never varie
the quantity of water-vapor which may, from time to time, mix up with
order to form the atmosphere, does vary very largely.

Secondly, the nature of the action of the sun keeps on changing in
place all day along; as the earth turns round, the different parts of the a
phere receive different quantities of heat at constantly shifting angles. So
with a perpetually varying mass of vapor to act upon, and with a perpe
varying power of action upon it, it is not strange that the working of th
upon the atmosphere should present an amount of confusion and of
disputation, for which even the Chamber at Versailles cannot offer a paral

So far we can comprehend, in part at least; but we get next to a qu
which really is a puzzler. We have been talking about evaporation, and
vapor, and about the sun, and, taking them separately, they have not offer
much difficulty; but now we must go a step further—we must put them all
together, and we must add to them a fourth idea, called condensation.
effect of this addition, which looks so simple in words, is to complicat
position gravely, and to lead us to a riddle which the cunningest of scie
people have hitherto been unable to solve. Under the influence of co
sation the sun-made vapor which, so far, was invisible, becomes converte
a visible object called a cloud: that is to say, according to the dictionary, '
a visible mass of particles of water suspended in the atmosphere;" this o
which is cold-made, constitutes the first external manifestation of weather-
the first obvious sign we see of it; it is the first product of that struggle bet
heat and cold which is the ancestor of everything else that we shall disco
weather. So far no objection can be made, for if weather is to exist at all
essential that it should have causes. But now comes in the insoluble en
Clouds, as has just been said, are made of water, and water is 816 times h

than air; how then do clouds manage to get lifted up into the air, and to stop there comfortably, apparently without an effort, and to travel thousands of miles there, at all sorts of paces, just as if it were quite natural and proper that they should be there? Nobody can tell us. Now really it is humiliating that at the very outset of our attempt to make the acquaintance of weather, we should encounter an obstacle of this sort, which bars the door to all possibility of real intimacy. Of course wise people have tried to scramble over it; of course there have been plenty of suggestions of the peculiar reasons which enable clouds to defy what are supposed to be the laws of nature, to despise attraction, and to mock at gravitation; but not one of the explanations which have been invented is considered to be sufficient; the clouds go on swimming incomprehensibly above us, in utter disdain of a number of excellent reasons why they should do nothing of the kind. If they behaved like everything else in nature, they would never go up at all; but then, in that case, they would not be clouds. Some learned gentlemen have asserted that clouds are supported by rising currents of hot air, which push them up from below, apparently just as children blow up soap bubbles and keep them floating as long as their breath lasts; others have considered electricity, in some unknown fashion, contrives to hold them in their places; others, again, have urged that the water globules of which they are formed contain "obscure internal heat," which by expansion makes them lighter than the surrounding air, converts each of them in that way into a Montgolfier balloon, and so enables them to remain suspended. We ignorant people are of course quite ready to believe any one of these interpretations, or any other, provided only the sages will tell us which one to adopt; but so long as they hold silence on the point, all we can do is to stare inquisitively at the clouds, and say within ourselves, "How on earth, now, do you manage it?"

The duties of a cloud are to supply us with water in all its summer and winter forms—that is to say, with rain, sleet, snow, hail, and fog; and to preserve us from excesses of both heat and cold by shielding us from the sun's rays when the air is too hot, or by preventing the radiation of terrestrial heat when it is too chilly. Children would, no doubt, insist on adding that an additional duty of clouds is to show us which way the wind blows. In order to accomplish these different functions, clouds adopt a variety of densities and shapes, and place themselves at a variety of heights; but whatever be the altitude at which they range, or the specific gravity or the form which they may momentarily assume, they are always at work at their vocation, and, as long as they are required, are unceasingly engaged in making weather. But all of them do not disappear "in the caverns of rain;" some of them fulfill other objects than shower-making, and do not vanish in drizzle; what becomes of these others when they are done with? What is the fate, for instance, of those fleecy, dreamy, high-bred looking clouds which come and go in the still hotness of July, which softly appear and as softly disappear in the silent summer sun-light? To this, at all events, we can give an answer; those graceful "muslings of the sky" are dissolved back again into vapor by heat: they remain water, but they

once more become water invisible. Like everything else around them, i in their power to cease to be; invisibility is not mortality. Their s unending life is told in Shelley's "Song of the Cloud;" their law is, "I c but I cannot die."

Of these imperishable clouds rain is the first-born child; it may be that it is, too, the favorite grandson of vapor. But notwithstanding its e position in the family, it cannot be said to be altogether a credit to its rel Rain is incontestably possessed of some most remarkable capacities; its are brilliant; its influence is enormous; but the value and the merit qualities are lamentably diminished by the capriciousness, the willfulne the disorder with which it employs them. Of course it has the exc having been abominably brought up, like all its kindred, and of never had the advantage of good examples at home, for neither weather, nor nor clouds, set their younger relatives a pattern of steadiness, of dignity regularity of conduct. But whoever may be to blame, the fact persists t merits and defects of rain are so intermingled, that it is sometimes very d to distinguish them from each other. Open-handed generosity and nig avarice; the gentlest and tenderest caresses and the fiercest blasts of t the most dashing and impetuous public speaking and the dryest and mos ful silence, are all mixed up together in this richly endowed but wildl ward nature.

And yet, with all its faults, rain does render us more service than the it comes from, although its benefits often lose half their value by coming wrong time. Its distribution is as unequal as that of wealth; like m bestows itself in excess in one direction, and does not give itself at another. It never rains one drop on the coast of Peru, in Northern A in the African Sahara, in central Arabia, or in the Desert of Gobi; but i gonia it scarcely ever leaves off raining. And in quantity it is as irregul locality; one inch a day is a heavy fall in England; but in the Highl Scotland three inches are not unfrequent; and at Gibraltar 33 inche fallen in 26 hours. If rain-gauges could be established out at sea, in the of the Equatorial Atlantic calms, it is probable that the heaviest fall w proved to occur there; but as pluviametry is, thus far, a process which applicable on land, we are temporarily obliged to accept the Khasia Hills site the head of the Gulf of Bengal, as the seat of the most abundant do that we know of, for there the rain of each twelve months attains the pro depth of 44 feet. The enormity of this dampness may be appreciated fact that even in the west of Ireland, where the whole swing of Atlan comes down eagerly on the first land it reaches, the yearly fall, in th moistest periods, never exceeds 10 feet, while in France the average is 30 and in Russia only 14.

As rain means vegetation, and no rain means deserts, the results o diversities glare out conspicuously; the existence of plants, and conse of animals, depends as much on water as on temperature, so that the abs

rain necessarily entails the absence of life. And here we leap, incidentally, into the very midst of an enormous question—the relationship between history and weather. Power, commerce, wealth grew up, some thousand years ago, in certain places, and not in others, as natural results of atmospheric influences. If the shores of the eastern Mediterranean were the first seat of the world's progress, it was not because they furnished easy water-carriage, but because they were illuminated by a sunny sky. The glories of Egypt, Greece, and Rome were, in reality, an affair of weather; they would have been utterly impossible in Lapland. Karnak, the Acropolis, the Coliseum could never have been built amidst snow and ice. The disposition to work out progress beneath rough skies is essentially a modern tendency; until a few centuries ago civilization was exclusively a child of warmth.

Of course it may be said that all this is a matter of climate rather than of weather, and there is some truth in the objection; but, all the same, weather alone, weather irrespective of climate, has had a good deal to do with history. It was, most certainly, weather which produced the Deluge; it was a storm which drove inhabitants to America, and another one which protected England from the Armada; it was snow which overwhelmed Napoleon in 1812; it was fog which helped Mary Stuart to escape the cruisers of Elizabeth, and to cross from France to Scotland; it was fog which enabled the Russians to get unseen up the hill-side at Inkerman. All this was weather. It is weather, not governments, which keeps the world as it is; the atmosphere is infinitely more essential to us than constitutions; if weather changed its actual forms of action, we should all of us have to change too. If rain happened to disappear in Europe, Europeans would disappear with it; the green fields of England, like the vineyards of France and the great corn-grounds of the lower Danube, would dry up into shriveled wastes; while, perhaps, the dreary plateaux of Thibet would grow into the garden of the earth. What would become of the Western march of civilization in such a case as that? It really is humiliating to see that politics and power are, after all, matters of mere mud.

The behavior of rain is a question of almost as much interest to us as its distribution. To be of real use it must come down in a certain way—neither too fast nor too slow; its drops must be neither too large nor too little; it must fit its shape to the period of the year and the needs of the soil; the driving mists of autumn, the short but heavy downfalls of July; "the sweet, fleet, silvery, April showers,"—as Lord Lytton, the younger, so deliciously calls them in that loveliest of poetic fables, the "Thistle"—must all arrive in their time and place. Luckily for us the personal manners of rain are not, like its general conduct, exclusively a product of its own capricious temper; they are influenced, to our great advantage, by something else than winds and sunbeams. The air itself guides and graduates the falling drops; it diminishes their eager speed by its resistance; it forbids them to attain accumulated rapidity; it shelters us by its universal buckler against a ferocity of pelting which, if left unchecked and uncontrolled, would flatten us at each shower. Even the size

of the drops is not quite left to hazard; amidst so much waywardnes disorder it follows, exceptionally, a sort of rule; it depends a good dea true, on the quantity of water in the cloud from which the drops emerg still, the rain which filters from the edges of a cloud is almost always fin small; that which tumbles from the middle of it is usually big, becau globules have an opportunity of mixing-up with those below them; wh the dripping finishes, the drops grow smaller, because, as there are fe them, they find no others to incorporate with as they descend.

The services which rain renders are not limited to the earth and it ducts; its action is not solely exercised on plants. Part of its good w done up above us, before it gets down to leaves and roots. It largely infl the air through which it falls; it cools and purifies it, and it seems even admitted as quite probable that, in certain cases, it washes away the ger endemic and sporadic diseases. If ever we could manage to find out a for directing the weather, it is not impossible that one of the results of t vention would be to enable us to suppress atmospherically-propagated infe and that, by a skilful use of the pail and mop on the air we breathe, we wipe out of it the taints of a good many sorts of plague and pestilence. pretty dream does not seem likely to be realized in our time; but it i perhaps, so fantastic as it appears at first sight, for, as we have found ou to master lightning, and how to lead it where we please—how, in f "inoculate thunder"—it is not altogether ridiculous to hope, that some d may do the same for rain.

Fog is the second of the children of clouds; so, at least, we may suppose; for though the successive dates of birth of the offspring of the have not been regularly inscribed in the family bible of nature, it reall look extremely probable that fog came upon the earth immediately after Indeed, there are wise men who calculate that it even preceded rain, an it is, consequently, entitled to the position and privileges of the first But, whether that be true or not, it is natural to us people of the nine century to place fog second; for, whatever may have been its exact ran merly, it is certainly, in our time, a vastly less important personage thar The aspects of the two brothers are so different that the hypothesis of possibly being twins is altogether inadmissible; scarcely any family lik can be discerned between them; rain is a cloud dissolved into falling fog is the cloud itself come down upon the ground; it is, like rain, compo water globules, but those globules have not burst, and the characters two kinsmen are as unlike as their external appearance. Rain is a spen who casts about his substance in every direction; fog is a miser who together all he has. Rain is invariably in motion; fog is always indole lazy. Rain is active, violent, and noisy; fog is stagnant, sulky, and Fog is manifestly jealous of his brother—gets into his way as much as po and seems to try fallaciously to prove that, as their common mother, can descend to the earth entire in the shape of her second son, it is alto

needless for her to tumble down there in pieces under the name of the elder one. Unfortunately, however, for the pretensions of fog, it is of no kind of use to us, while its liquid relative is indispensable. It seems, indeed, to know this, for it likes particularly to stop in inaccessible places, on mountain tops or out at sea, where scarcely any one can look at it, as if it were ashamed of its condition. It is true that it does visit us occasionally on dry land, but in a nasty, hesitating sort of way, and it rarely presumes to show itself amongst us in broad daylight. Most of the other members of the family of weather—with all their faults—have some redeeming qualities; but fog is hopelessly objectionable: it is ugly, useless, stupid, and dirty.

The third child is a daughter. She floats in the winter air in the white frock that was given to her at her birth, and though she is now as old as the north wind, she has never changed her robe. Cold, still, spotless and majestic, she seems altogether out of place amidst her coarse relations: they are a disorderly populace; she is a stately queen. Silent, frigid, and so white that her very name means purity, she stands alone—the Pallas Athene of weather. Her movements are soundless; she hushes all around her; she effaces everything she touches: all signs of life are hidden beneath the noiseless veil she spreads. Immaculate, irresistible and eternal, she possesses an awfulness and a grandeur which are special to herself. Nature has produced no counterpart of her; and it is, perhaps, as well that she has no sister, for if the clouds had two unmarried daughters of her type, mankind would have hard work to get through the winters. The immensity of her power can, however, be judged only in her own chosen homes; and it is indeed well worth our while to visit them, for of all material royalties there is not one like hers.

And yet this splendid vestal is not invariably the mighty, ruthless, immutable sovereign that we behold on the mountains and at the poles. Like all other rulers, she has her weak moments. It is saddening to have to own that so superb a princess can ever change her glorious form, but the truth is evident—she thaws! Her attributes of whiteness and eternity are, after all, mere questions of thermometer and position; they dazzle our bewildered eyes as we humbly gaze upon them on the Summits of the Alps; they turn into dirty water in Pall Mall. We easily forget when snow is sitting nobly on her throne, that the plebeian blood of rain and fog is running in her veins; but she herself, despite her majesty, is forced to own the lamentable fact as soon as she gets warm. How she must hate heat! To be glorious, brilliant, stainless snow, all grand and undefiled and beautiful, and then, because the sun shines out a little, to be obliged to vanish into puddle! What mockery of the greatnesses of this earth!

But, after all, it serves no purpose to be sentimental. If negroes have black skins, if cows have horns, while sheep have not, if tigers prefer flesh to oats, it is because those peculiarities are special to their race, and are inherited by each member of it. For the self-same reason snow is condemned to thaw; water she is, to water she returns; only it really is a pity it is not always clean.

As for the uses of snow, it would be absurd to talk about them. S too beautiful and too royal to be used. Let us leave her where we foun in the air, and on the crests, up there amongst the eagles; let us forget th can melt, and that she has functions to discharge.

But what can possibly be the functions of her next brother—hail? C crops to pieces and breaking panes of glass cannot seriously be called a tion, and yet, what else does hail do? Indeed the presence of this cr amongst the connections of weather is decidedly an enigma. It is a ch the clouds; that is certain; but it is a child whose birth is shrouded in my for nobody has found out exactly how hail is made; and as we are equally rant of its uses when it is made, it really may be urged that, perhaps, it be just as well if it were never made at all. It is manifestly the bully family; it never rendered a service to anybody; on the contrary, it is a doing damage in the wilfullest and most senseless fashion. And, further it is an undutiful and disrespectful son, for, as it comes down frozen into reveals to us, with the most shocking indiscretion, that it must sometim most horribly cold in its mother's lap, which is a distressing fact that no affectionate, deferential son would ever consent to divulge. It has observed twice already, that the clouds have brought up their proge abominably, but this one is really worse than all the rest.

There ends the list of the offspring of cloud. Dew is her little br not her child; for, like her, he issues direct from their common mother invisible vapor suspended in the atmosphere. He is, consequently, small is, the uncle of rain, fog, snow, and hail. He has the merit of being th single member of the entire family whose manners are always perfect; h charming, laughing, bright-eyed little fellow—a blithe and sparkling mo visitor, who opens the day for us with smiles. He, like his superb niece, has a name which we have adopted as an emblem; as she is purity, so freshness; and well indeed does he symbolize that word—for what else is like dew? This baby boy of vapor is the great jeweller of nature; it who sprinkles her with flashing gems; it is his bright handiwork which the leaves and grass-blades glisten in the early sun: his workmanship is i so brilliant that we almost doubt his origin, and have some difficulty in b ing that he is really of the same rough race as weather and its brood. B proof thereof is close at hand: he can freeze; he can become hoar-frost then, alas! when his drops have turned into crystals, he thaws, and disap in dirty water, as is the habit of his lineage. Poor, little, charming dew does deserve a better genealogy.

Shadow and shade, too, are not the children of cloud: they are simpl pupils; she does not create them of her substance—she only forms them b teaching and example—she passes by and says to them, "Follow me;" and do it. But still they are important elements of weather; for it is they who the place of sunbeams when the sky is grey; it is they who soften dow noon-tide glare—who mark the days of rain, of dulness, and of winter.

they, again, who flicker fitfully on the hillsides and the plains—who pass in spots of undulating darkness across the "whisperous wheat" (Lord Lytton again)—who overcast the sparkling waves with deep-blue moving patches—who add to nature's sweet variety, by playing with the light amidst her work. They constitute the one real charm of weather; it is they who give to it its color, its wandering diversity of tone, its ever-shifting glow. The sombre, slaty gloominess of the storm time—the whitey-grey of the morning mist—the sharp, clear, marching images which mark the passage over us of the hurrying autumn clouds—the distant dimness of the coming rain—the July contrasts between hot lustre and cool calm—all these are the doings of shadow and shade. Without them weather would be all darkness or all brilliancy, according to its passing humor; with them it becomes as variable in aspect as it is in temper, and nature gains a beauty the more.

Thunder and lightning form a strange couple by themselves: they are neither relatives nor friends of the family of cloud; they seem indeed to be barely on visiting terms with its members, for they come to see them very rarely; sometimes even not for months together; they live apart, and show themselves only on great occasions. Their precise situation in the set is rather difficult to define; but it may be said, with approximate exactness, that they are to weather what swearing is to respectability, what cholera is to disease, what a lion is to beasts. It is possible that they may have a use; but, if so, it has not been yet discovered; for, as their tremendous grandeur is out of all proportion with their ordinary effect of turning milk sour, it really cannot be reasonably supposed that they were created solely for that minutely destructive purpose. Neither can it be seriously pretended that their object is to furnish proof that mankind can easily be terrified by sudden flame and sound. So far as we can thus far perceive, they appear to be a pure expletive, superb and violent, but like many others of the manifestations of weather, totally incomprehensible.

And now we can begin to approach the self-constituted guardian of the entire group; the domineering master who drives its members all about before him with a temper even more capricious than their own, but whose guidance is so absolutely indispensable to them all, that without his aid neither clouds, nor rain, nor snow, nor shadow, could move one inch. What would they all be without wind? In order to completely govern them, wind assumes as many forms as color does; and even in these days of observatories and weather charts it is scarcely possible to establish a complete catalogue of them all. There are hot winds and cold winds, wet winds and dry winds, sea winds and land winds; permanent winds, like the trades; periodical winds, like the monsoons; and variable winds, like those we have around us here; there are mountain winds, valley winds, and plain winds, "brave west winds," hard northeasters, and "fainting air"; and there are all the varieties of local winds, special to particular districts, like the sirocco in Italy, the simoon in Arabia, the kamsin in Egypt, the harmattan in Guinea, the mistral in France, the "hot-

winds" in Australia, the fohn in Switzerland, the nortes in the Gulf of
But all these diversities are, in reality, alike in their origin and natur
the lazy breath which does not lift a leaf, to the hurricane which voyag
as fast as the quickest railway train, they are all substantially identical
are currents in the atmosphere.

If there were no wind, weather would be immovable; it would rise
disappear on the same spot, according to local causes; there would be
of relationship or sympathy between the weathers of different distri
there were no wind the modern science of meteorology would have no ex
for if nothing carried storms and rain in a recognized direction, and
recognized speed, we could not be told by telegraph what will probably
nature of the weather round our coasts to-morrow. Steam has rend
tolerably independent of wind for navigation; but, thus far, the other
wind have not been replaced by machinery; it alone continues, among
of its occupations, to be the sole known means of transporting clouds ab
sky. And, in addition to its general duty as a carrier, wind has a speci
tion to discharge in the composition of weather, for it is it, and it alone
makes storms; it is it alone which puts weather into a real rage. Wi
weather would often be sulky, gloomy, disagreeable, but it would n
ferocious. Hurricanes, cyclones, tornadoes, and typhoons are, virtuall
wind, and yet they incontestably present the most outrageous forms
weather can assume. Without wind all the other elements of weather
be passive; in themselves alone they constitute mere local agencies; it
when their inherent power is multiplied by the speed which wind bestow
them that they acquire destructive force. It is the wind which enal
snow to drift and deepen, the rain to travel over whole countries and t
date them all; the hail to beat down the crops of entire districts; the
march along from sea to land. If "life is movement," it is evidentl
which bestows life on weather.

Wind, however, in the midst of its inconsistent caprices, is controll
all the other elements of weather, by the degree of heat. As heat make
so also does heat make wind; and we have proof thereof in the fact t
average number of storms each year rises gradually from two in Liberia
in London, fourteen in Paris, forty-three in Rome, and sixty in C
Whenever a tempest occurs we may be absolutely certain that temperatu
the bottom of it, for wind of all speeds, from one to 100 miles an ho
mere rushing of air to take somewhere else the place of other air wh
been carried off by hot ascending currents. But, in tearing about i
seems to be so fantastic a fashion, wind is unceasingly rendering us a v
vice; it is conveying vapor from damp places to dry ones. If ever it
leave off doing so, evaporation in the dry places would become great
precipitation; the level of the inland waters would fall, vegetation wou
appear, there would be no more food, and the population would be
away. And all this because the wind would have stopped blowing in th

tion where it is wanted! There is no doubt at all that such would really be the case, for it has happened already round the Caspian and the Sea of Aral.

The relationship of wind towards weather is somewhat like that of a painter's brush towards his colors; without the brush the colors would remain daubed upon the palette, but with its help they form a picture. It is true that in the case of weather the picture is inharmonious, irregularly drawn, and indiscriminately shaded; but still it presents a vigor and a life which indicates that it is the work of no common hand. We gaze each day, and each hour of each day, at the great fresco which is painted for us by the winds, and yet, habituated to it as we are, it never tires us; it perpetually strikes us by its grandeur, its vitality, its ever-varying lines. It may, indeed, be said that the view of it constitutes one of the few permanent pleasures that we possess, and it has the advantage over most other pleasures of being obtainable without an effort. And yet though we have this strong reason, and many others too, for feeling gratitude towards wind; though it serves us as a water-carrier, as a seed and pollen-spreader, as a scavenger, as a drying-machine, and as a grand artist, it is probable that the greater part of us never entertain towards it any lively sentiment of thankfulness, and that we habitually limit our acknowledgments of obligation to it to the direct and personal benefits which it occasionally renders us, as when, on the evening of a sultry day, a breeze springs up and brings us coolness, or when it, at last, conveys our ship into port after a weary voyage. For the daily, constant work of wind we have no gratitude; if, indeed, we think of it at all, it is rather to cry out against its violences than to thank it for its services; they pass, unperceived, before our negligent eyes. Here, however, we are forced to recognize and proclaim them, for, without wind, all the other elements of weather that we have been talking about would be as motionless and as torpid as a mushroom in a hollow tree.

There is one more constituent of weather—temperature; it is usually and most rightly classed with climate rather than with weather, but yet its relationship to the latter is real enough to oblige us to include it in our list. It is dependent mainly on latitude and altitude, so much so, indeed, that it may be said—as a rough formula which is subject to many exceptions—that heat diminishes at the rate of about 1° Fahrenheit for each degree of distance from the equator, and for each hundred yards of height above the sea; but still it is a little influenced by mere weather too, only in the latter case we have no sort of law to guide our calculations of probable results. We all know that, as rules of climate, there are no very violent oscillations of temperature in the neighborhood of the sea, and that heat diminishes as we advance into the interior of continents, and leave the sea behind us. For instance, Amsterdam, and Warsaw, and Copenhagen and Kasan, are, respectively, on about the same parallels of latitude, and yet their mean annual temperatures are 53° and 46° in the first case, and 45° and 37° in the second. This we can understand, because it is climate—that is to say, a fixed condition. But we altogether fail to comprehend why July in England should have been a hot and dry month in 1874, and

a wet and cold one in 1875. That striking contrast was distinctly and
niably brought about by weather, and nothing else; and it is, for the
reason, altogether unintelligible to ordinary people like us. Of course it
enough to explain it scientifically, but what good does that do to us? Of
it can be announced that what happened this year was a necessary re
exces sive condensation of vapor over the British Isles, provoked by the
of unusual frigid currents in the atmosphere, which currents were sent o
by perturbations in the movements of the strata of the air somewher
above Japan, for instance, or towards Cape Horn. But that learned in
tation, supposing it to be infallibly exact, affords very small satisfaction
for even if we comprehend it theoretically, we fail altogether to realize
fact. Notions of atmospheric equilibrium, of compensations, of its bein
dentally cold in London because it is accidentally warm in the Gallapag
outside the grasp of the mass of us; our conceptions of the causes of s
changes of temperature are, habitually, more simple. If it becomes ve
we expect to be informed that a new comet is in sight; if it turns very co
cannot help suspecting that some icebergs must have floated down to the l
of Aberdeen. As for referring a broiling afternoon at Brighton to a st
Calcutta, or a chilly week in August to a magnetic disturbance aroun
Zealand, not one of us is capable of it. And yet these versions would
true ones, while the icebergs and the comets would be all nonsense.
not adopt them, however, because, as popular ignorance fits in handily w
prejudices, while scientific reasonings appeal only to our understandi
find, in this case as in so many others, that it is vastly easier to let ou
be guided by imagination than by knowledge.

And yet, indifferent as we may be about explanations, we are inv
ready to blame weather for all excesses that occur in temperature; ou
language proves it; we say "hot weather" and "cold weather," as if hea
cold were properties of weather. Nothing can be more unfair than this
perature is often somewhat exaggerated, either way, by weather; that is
true; but the fundamental fact that it is cold in winter and hot in summ
nothing on earth to do with weather. Weather is an extraneous influence
temporarily increases or diminishes the action of certain permanent
laws, but it no more makes those laws than tailors weave the cloth out of
they cut our coats. The presence or the absence of clouds, of rain, of
of wind, does manifestly affect temperature; but it affects it only bec
existed already. Weather is nothing but a tool in the matter; it shap
fashions temperature some little, but we could no more produce temperat
the help of weather alone than we could manufacture a piece of calico
pair of scissors and a thimble.

But though weather exercises only a very restricted action over t
rature, its authority is extensive over everything else that it touches. A
has been already made to several of its material functions, and all that n
added on that chapter of the question is the general observation that, as r

the culture of the ground, weather is even more important than the nature of the soil itself. The French express this truth by a proverb which is in all their peasants' mouths—"Mieux vaut un bon temps qu'un bon champ." Crops are almost entirely dependent upon weather. The supply of corn, wine, and oil, and of all the other necessaries which we have successively learnt to cultivate, is mainly a question of more or less heat and cold, of more or less wet and dry. All that is evident, and needs no telling. But the ways in which weather dominates over the persons of men and women are perhaps less generally noticed, and may therefore be worth a passing allusion.

Our virtues and our vices, our temperaments and our passions, are all so bound up with our physical organization that they cannot help varying with the outside influences to which the latter is exposed. We see proofs enough of this in the radical differences of national character between the inhabitants of countries whose climates are unlike; and though the variations of temper and disposition which are provoked amongst dwellers in the same country, by changes of weather alone, are insignificant when compared to the far greater consequences produced by climate, yet they are distinct enough to supply evidence of the reality of the cause which begets them. That heat engenders indolence and irritation, and develops the nervous system; that cold engenders activity and energy, and develops the muscular system—are facts with which every one is acquainted, for they are general rules in constant application before our eyes. But these rules and their effects are modified each day by the action of weather and there it is that we detect the special consequences of that action. And it is particularly easy to do so in a climate like our own, where the usual absence of extremes of temperature permits equilibrium between the muscular and the nervous system, and renders both of them, for that very reason, more accessible to atmospheric variations than is the case amongst inhabitants of excessive climates.

That is, no doubt, the reason why thunderstorms give some of us bad headaches, why long rains augment our national solemnity, why persistent fogginess and chill depress us, why brighter skies than those we habitually see excite in us a momentary gaiety and elasticity, which, in our astonishment and want of practice, we rarely know how to utilize, and, in differing degrees and shapes, these same conditions apply in other countries than our own; a large part of Europe takes the exact shade of its character for each day from the weather which it finds when it opens its eyes in the morning. It is true that, in the majority of cases, we are almost unconscious of the subtle influence which is thus at work upon us, not only because its effects are usually too minute to attract our attention, but also because we are so accustomed to them that unless they happen to be exceptionally marked, it does not occur to us to investigate their cause. This indifference applies, however, to a good many other things besides weather, and the fact of its existence no more indicates that the action of weather on us is not real, than our forgetfulness that we are always breathing implies that we could do without air.

And, furthermore, this indifference is limited to the present; it do extend to the future; it in no way prevents us from trying to discover for prognosticating coming weather; in that direction, at all events, our have always been inquiring and our attention has always been active. curiosity that the whole world feels upon this question is legitimate and n for though no amount of previous information would render weather less cious, yet its capriciousness would be less damaging and annoying if w well beforehand what changes to prepare for. It is therefore disagreeabl obliged to recognize that there is no present probability whatever that w ever attain any distinct knowledge on the subject. It is true that w invented the barometer, and that in these latter days we have had reco scientific observation on the largest international scale; but still, with help, we do not manage to see beyond to-morrow. And even that small into futurity would be impossible if we did not know by telegraph wh happening elsewhere yesterday. Failure, however, does not discourage go on calculating and seeking; we are pushed on in our researches by a sal curiosity—by a curiosity which seems to have always existed, and wh grown particularly strong during the last two hundred years. To satisf world has had recourse to prophets, who have really discharged their fu with such a remarkably correct appreciation of what was wanted from that the work of Maury and Fitzroy becomes lamentably mean and littl pared with that of Zadkiel and Moore, of Mathieu Laensberg and Matl la Drome. Those soothsayers were not restrained by the miserable c rations which influence the learned gentlemen who are trying to replace in their hands prediction was comprehensive, unhesitating, and feroci scorned the absurd bonds of time and truth; it satisfied all wondering; tented all sorts of fancies, for, not restricting itself to the mere prophe weather twelve months beforehand, it threw in revolutions, wars and pla well. Much time will probably be required, and much spread of educati before weather charts will be accepted by the masses as a satisfactory tute for thrilling penny almanacs. Dry facts can scarcely be expe easily replace superstition, and as the superstition is, in this case, the c property of all Europe, its eradication will be proportionably more diffic

If ever the happy time arrives when official weather-books will l lished annually at Greenwich; when rainy days will be calculated prosp with as much certainty as eclipses; when the date, nature and duration storm will be rigorously determined two years in advance—then, evider astrologers will have to abandon their profession. Meanwhile, howev will probably continue to exercise it without much hindrance: the only competition they have as yet is, not meteorology, but nature herself, fo generous enough to place at our disposal a variety of little signals, whic us some service as it is, and would render us much more if only we kn to read them aright. In her hands coming events do really cast their s a few yards before; and, if we were clever at discerning the meaning

shadows, they would perhaps tell us more about the movements of weather than we have hitherto been able to learn from the united observatories of the world. We know, for instance, in a general way, that we may reckon on a duration of fine weather if the sun sets in crimson clouds and rises brilliant, or if the stars are numerous and bright; that dews and white morning fogs are symptoms of clear days; that if the sun is dark and vapory, or if the moon is sickly with blunt horns, and a circle round her, or if the stars are pallid, big, and do not scintillate, we may look for rain; that if the sun comes up pale and then turns red, or if the moon is large and ruddy, with sharp, black horns, we may count on wind. We have noticed, also, that certain plants have ways of warning us of coming wet; that several of them shut up their flowers when rain is approaching; the chickweed, indeed, has this habit to such an extent that it is called in France, "the poor man's barometer." And there are enthusiasts who pretend that even animals are good enough to speak out, after their fashion, on the same occasion; they assert that, when rain is in the air, horses hinny, oxen low, sheep bleat, asses bray, and crows, frogs and ducks become particularly noisy.

But the birds are the best judges of all, for they live in the air and feel its pulses and its throbbings; they are specially organized for the purpose. Toussenel, indeed, goes so far as to say that every bird possesses within itself the various properties of the thermometer, barometer, hygroscope, and electroscope. The cranes were perfectly aware what sort of a winter was approaching in 1812; they proved their knowledge of its nature by migrating weeks sooner than their usual date in order to get out of its way. Unluckily for Napoleon he did not recognize that fact as the cranes did. Neither do we of this generation pay much attention to the instructive auguries which are offered to us by the swallows when they fly low, or by the sea-birds when they hover close to shore instead of traveling out over the waves, as is their habit when the weather is going to be fine. It is perhaps not altogether absurd to suggest that a system of predictions might yet be organized by careful observations of the proceedings of the birds; but as such a device would not be scientific, there is no actual prospect of its adoption.

The notion that the moon exerts an influence on weather is so deeply rooted that, notwithstanding all the attacks which have been made against it since meteorology has been seriously studied, it continues to retain its hold upon us. And yet there never was a popular superstition more utterly without a basis than this one. If the moon did really possess any power over weather, that power could only be exercised in one of three ways—by reflection of the sun's rays, by attraction, or by emanation. No other form of action is conceivable. Now, as the brightest light of a full moon is never equal in intensity or quantity to that which is reflected towards us by a white cloud, on a summer day, it can scarcely be pretended that weather is affected by such a cause. That the moon does exert attraction on us is manifest. We see its working in the tides; but though it can move water, it is most unlikely that it can do the same to air, for the specific gravity of the atmosphere is so small that there is

nothing to be attracted. Laplace calculated, indeed, that the joint attr of the sun and moon together could not stir the atmosphere at a quick than five miles a day. As for lunar emanations, not a sign of them ha been discovered. The idea of an influence produced by the phases moon is therefore based on no recognizable cause whatever. Furthermo now distinctly shown that no variations at all really occur in weather moment of the changes of quarter, any more than at other ordinary Since the establishment of meteorological stations all over the earth, it ha proved by millions of observations that there is no simultaneousness wh between the supposed cause and the supposed effect. The whole sto fancy and a superstition, which has been handed down to us uncontrolle which we have accepted as true because our forefathers believed it. The exercises no more influence on weather than herrings do on the Governm Switzerland.

Regarded as a whole, the question of weather has the double m being both important and interesting. It has, from all times, dragged t itself the attention of the ignorant and the wise alike; philosophe peasants have studied it with equal attention, but with equal non-succe has always persistently hidden its secrets from us, or, at best, has opene to us in the most limited degree. Our attempts to fathom them have o us into superstition; and of all the branches of knowledge which me pursued, it may be said, with truth, that there is not one in which the made so little progress as in weather-lore. Maury's discovery of the storms is the one single contribution that has yet been made to the crea a weather science; and even that law has extremely limited applicatio is open to innumerable exceptions. In no other direction, whatever, h been able to detect any appearance of a rule; we have traced out caus not codes; we have got on a little with the former, but the latter remai visible to us as they were to Aristotle. Indeed, if such a thought were flagrant contradiction to the whole of experience in other directions, we be almost tempted to imagine that, in this one matter, nature has not act her usual precision, and that she has drawn up no code at all. That e tion of the caprices and inconsistencies of weather is, however, inadm there must, of necessity, be perpetual laws for its guidance, as for eve else; it is only as a justification of our own ignorance that we incline t that there are none.

That being so—and assuredly it is so—our admiration for nature's c of lawgiving ought to increase immensely; for the statutes which she l vented for the government of weather must be far more wonderful thar which she enforces elsewhere. They imply the existence of the strictes amidst indescribable disorder; of a recognized predominant will where a appear to be contending for the mastery; of an accepted absolute comm where all looks like flagrant disobedience; of ever-present reason amid seems to be the wildest incoherence; of all-controlling despotism, co-e

with the outward signs of absolutely uncontrolled liberty. It must be owned that the task of comprehending this is excessively embarrassing, and that we really have some small excuse for trying to evade it. In other cases the laws which nature applies are in more or less harmonious agreement with the agents which they employ, and with the effects which they induce; but here the agents and the effects present themselves before us in such tumultuous confusion, in such wayward independence, with so vivid and so resolute a character of immunity from supervision, that it is most desperately difficult for us to imagine that there can be any harmony at all between them and the unknown laws which we suppose to be directing them, but which they seem to so thoroughly despise.

It is humiliating to turn away from an unsolved riddle; but, as nobody has ever been able to explain this one, it is not likely that we should be successful, even if we tried. Let us leave it to posterity, and, with it, let us bequeath the wise advice which Mathieu Laensburg offered to his readers—"Il faut prendre le temps comme il vient, les gens pour ce qu'ils sont, et l'argent pour ce qu'il vaut." —*Blackwood's Magazine.*

NOTE.—In the March number, we will commence, as a regular addition to the Magazine, a chapter upon travels, adventures and geographical discoveries. Well written articles upon the climate and physical geography of countries, and the manners and customs of people, are solicited.

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The Natural Sciences.

E. H. FITCH, Editor and Proprietor.

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Any papers sent to the editor will be carefully preserved, and returned to the contributor if desired.

The Secretaries of Scientific Societies are respectfully solicited to forward to the Editor, as soon after the meetings of their respective Associations as convenient, all reports of the proceedings and synopsis of essays and addresses read before them.

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FIG. 2. AMERICAN COOT.

The Scientific Monthl

DEVOTED TO THE NATURAL SCIENCES.

VOL. I. MARCH, 1876.

THE COOT.

(*Fulica Americana.*)

BY W. H. MACHEN, TOLEDO.

The extensive marshes and numerous shallow inlets, found in the of our lakes and the low lands bordering on many creeks and rivers, con so to speak, a transition from dry land to navigable water; they may, th be said to belong neither to the one nor to the other, or—more appro still—to partake of the nature of both.

In these, apparently so little favored localities, hundreds of different of reeds, grasses and other aquatic plants are found growing in great pr and affording, by reason of their rank and dense vegetation, suitable ha the numerous species of the feathered tribe which frequent our waters. large flocks of ducks and geese congregate to feed on the nutritious suc culent roots and stems of such plants as thrive best on a marshy soil, being either constantly submerged or exposed, at least, to frequent inund as storms and freshets swell the streams and rivers or winds and gales im hold a great volume of water in one direction. Here they often fin retreat from the deadly weapon of their indefatigable and ubiquitous fo man, and a friendly and no less sure cover against the sharp talons of t duck-hawk.

But aside from the numerous web-footed denisens of the air freq these places, there are other classes and families of birds which con attach themselves to the marshes and do not wander to any considera tance away from them whether on dry land or in open water. To th belong the noisy rails, the cackling gallinules, the bitterns and the Am Coot, the subject of this description.

In the same manner as the natural haunts of the above named mars partake of the nature of dry land and water as well, so these birds the

have many characteristics which bear a marked analogy to several genera entirely terrestrial on the one hand or more decidedly aquatic on the other. In none are these points of resemblance more strikingly obvious than in the Coot. Approaching the *gallinaceæ*, the most terrestrial of birds, in the shape of its bill, in the outline and smallness of the head, in the fullness of the body, the convexity and rounding of the wing and the strength of legs and toes; it resembles the *natatores* or web-footed in the backward position of the legs, the shortness of tail, the slender neck, and above all in the semicircular lobes with which the long toes are supplied both interiorly and exteriorly. These lobes (See *Fig.* 2) which take the place of and perform the same office as the connecting membranes of the *Natatores* or web-footed water-fowl, enabling the Coot to swim with ease, serve also to supply a firmer support when walking, with nimbleness and speed, on the alluvial soft mire; while the toes themselves, by being entirely detached from each other, meet with no obstacle in their free and independent action.

For though the peculiar structure of their large feet and the situation of the legs appear to offer plausible grounds for supposing the Coot incapable of moving on land with any degree of speed; yet experience proves the contrary, for they use their legs well, and when alarmed run with great speed. They are accustomed to leave the water and resort to open lands on the margins of ponds and streams for the purpose of feeding both in the morning and evening. When thus engaged, their movements are brisk and they have been observed to strike at each other in the manner of the domestic fowl, running also with surprising agility.

While swimming they move with ease, yet without great speed, keeping their heads continually in motion by a series of nods corresponding with the strokes of their feet. They rarely resort to diving unless to elude the talons of the much-dreaded duck-hawk or in endeavoring to escape hunter or dog. When wounded they will make for the nearest reeds and lie flat or swim to shore and hide in the weeds, a habit common to most aquatic birds when wounded or disabled. Whether they dive for food is doubtful. The small minnows sometimes found in their gizzards are probably caught in shallow water.

When undisturbed they feed both by day and night, and as often on land as on water. Their food consists of seeds, grasses, aquatic plants, small fishes, molluscs, small frogs, snails, worms and insects, and along with this food they swallow a quantity of small pebbles and coarse sand.

Rising with some difficulty they fly swiftly, and much in the manner of the gallinaceous birds, the rapid motion of their wings producing a whirring sound. They appear to take to wing with some reluctance, except during their periodical migrations. When suddenly alarmed or shot at, those not wounded often scatter without rising, patting the water with their feet, and rushing with extended wings for a hundred feet or more without actually flying.

While migrating they are very shy, and rise on slight provocation, flying in flocks at a considerable height, half a mile or more at a time, without, however,

uttering any note. Their only sound appears to be a short *cluck*, not that of the domestic hen, which they produce when alarmed or when c each other on the water. It is highly probable that the continued ca reported as coming from Coots, is in reality that of the Gallinules and R. different species, which have been confounded with the Coot in this resp

During the winter months Coots are very numerous in Florida and I ana. At that season some of the secluded bayous, grassy ponds and inl plentiful in these regions, literally swarm with them; but, on the ret Spring, they all depart for the north, and separate in pairs for the pur incubation. There can be no doubt but many continue their migration north than the United States, while others breed in the extensive mars the vicinity of our northern lakes.

The nest of the Coot is constructed of decayed vegetable matter and sticks. It is placed among the reeds, and when, as sometimes happ inundation carries off the whole structure, it floats on the waves without to the eggs, or displacing the female. The eggs, seven or less in numb of an ashy-grey tint, spotted minutely with black. The young take water as soon as hatched, after the manner of most water-fowl.

The American Coot, *Fulica Americana*, belongs to a genus which nu but ten or twelve species, and of which the European Coot, *F. Atra*, ha constituted the type by naturalists. The characteristics of the genus are—Bill shorter than head: straight, strong, compressed, and advancin into the feathers of the forehead, where it frequently forms a somewh jecting frontal plate. Nostrils in a groove, with a large membrane ne middle of the bill. Wings short; second and third quills usually longest. very short. Tarsus robust, shorter than middle toe, with very distinct verse scales. Toes long, each toe having semi-circular lobes; hind to and also lobed.

All the birds of this genus are of a dark slate color, and bear a resemblance to each other.

The characteristics of the species, *F. Americana*, which is found thr out the entire temperate regions of North America, are:

Bill, as long as head, straight, compressed, higher than broad at Culmen, from frontal plate to midway of tip, slightly inflected, thence gentle downward curve to tip, which is somewhat obtuse. It is rounded, near the forehead, where it slightly flattens, and ends with a semicircular partially enclosing the frontal plate, which is oblong, soft, tumid, and asc well on the forehead; the edges are slightly overlapping, sharp, with an tinct notch near the top. Nasal groove wide, extending to two-thirds entire length of mandible, covered with a soft membrane. Nostrils, lateral, situated midway the bill. Angles of lower mandible long, n rounded; dorsal line nearly straight, running obliquely upward, the flattish, the edges sharp.

Head small, oblong, much compressed; neck slender; eye medium, situate midway between line of bill and top of forehead.

Body rather full, compressed. Feet large, strong. Tibia bare about one-fourth of its length. Tarsus shorter than middle toe, much compressed, widening below; anteriorly covered with broad scutellæ, laterally with very small, nearly quadrangular, scales, which are likewise constituting the covering of the tibio-tarsal joint; another row of scutelliform scales on the outer side, behind. Hind toe slender; middle toe longest; outer considerably longer than inner; toes sculellate above; row of scales widening somewhat on the joints; hind toe with a narrow lobe, covered with small diamond-shaped scales; fore-toes with lobes corresponding with joints. Those on the inner side of toes much the larger, narrowing opposite each joint to about one-third their greatest width, covered with four rows of scales, the nearest to the toe taking up nearly half the width of lobes, others proportionately diminishing in width as they are farther from the toe. The lobes of outer toe narrower, and forming a less decided curve than those of the other. The lobes of the last joints reach to, but do not include the callous protuberances supporting the claws, which are of moderate length, slightly arched, much compressed, acute; claw of middle toe with a slight edge interiorly; that of outer stoutest, and having also a decided curve inward; that of outer toe weakest. (Compare *Fig.* 2).

Plumage soft; short on head and neck. Wings short, broad, rounded; primaries much curved. Second primary longest; third 1-16th inch; first and fifth 5-8th inch; tenth $2\frac{3}{4}$ inches shorter. Tertials, which are soft and elongated, extend to the end of longest primary; secondaries rounded, or with a very obtuse tip.

Tail short, weak, composed of twelve soft, weak, rounded feathers; upper and lower tail coverts nearly as long as tail feathers.

The color of the bill is light ashy, with a large tinge of yellow, and inclining to flesh color near and above nostrils, with a broad band of grey-brown between nostrils and tip. Frontal plate light red or nearly white during life, of a reddish-brown after death. Irides bright red. Head and neck of a soft bluish-black, with a fine silky gloss; breast and side, bluish-slate; wing coverts a shade deeper; scapulars, dorsals, and rump-feathers tinged with a dark olive lustre, feathers on lower parts frequently edged with ashy, imparting to these parts a slightly mottled or barred appearance. Quills brownish-slate, inclining to sooty-black near the tips; the edge of the wings, outer margin of first quill and tips of secondaries white. Tail brownish-black; lower tail-coverts white. Interior of wing bluish-ash. Legs and toes of a bright green inclining to lead color on the edges of the lobes and the extremities. Claws black.

There is no appreciable difference in color between the sexes. The young are much like the adult, but with the under parts lighter and more mottled; abdomen frequently ashy-white; head and neck slate-colored instead of black, and lacking the gloss observable in adult specimens.

The following dimensions were taken on an adult male, collec Nov., 1875:

Length from tip of bill to extremity of middle toe .	22¾ inches.
" " " " " tail . .	16½ "
" " " " occiput	2 11-16th
" " " " carpal-joint . . .	7 inches.
" of bill from tip to forehead, including frontal plate	1 13-16th
" of bill from tip to angles of mouth . .	1 5-16th
Height of bill at base	11-16th
Width " "	½ inch.
Distance from tip of bill to nostril	11-16th
" " " " eye	1 9-16th in
Length of closed wing	8 inches.
Stretch of wing	27½ "
Tarsus	2⅜ "
Middle toe, 2 11-16th inches; its claw . . .	½ inch.
Outer toe, 2 3-16th " " . . .	5-16th in
Inner toe, 1 13-16th " " . . .	7-16th
Hind toe	15-16th
Tail extends beyond tip of longest primaries . .	1½ inches.

It is especially the construction of the foot, and the lobiform attacl of the toes, which constitute the special characteristics of the Coots. tively considering the peculiarities of the mechanism of these parts w discover many things worthy of admiration. The disposition of the sc the lobes is so arranged that, when the bird is swimming, the lobes are ex by the resistance of the water; the several rows brace each other at the and prevent the flexible lobes from bending too much upward, which greatly impair the propelling power. When the foot is closed, howe toes and their lobes fit closely together, and present but very little s The system of lobes, moreover, does not interfere with the prehensile pc the foot, which becomes of great use when, at some sudden flood, th perches on the highest reeds to await the fall of the waters. It is notabl wise, that the inner toe, the lobes of which are much more developed detached from the middle toe, and consequently more susceptible o dent action than the outer.

There are, no doubt, many other particular features in the conforma the different members of the Coot's body, which, could we but understan use and special design, would fill us with wonder. It should be the aim zealous student of nature to endeavor to unravel her manifold m by the aid of the limited lights, science has thus far thrown u things, as yet almost completely hidden from our understanding, t

proper appreciation of the ends for which everything has been created by an Omnipotent and All-wise Ruler whose infinite wisdom is reflected in His every work:—no less in the Coot, the humble inhabitant of the uninviting marsh, than in the fierce and bold condor, which, perched upon some unaccessible cliff, casts its penetrating glance into the sun; no less in the beauty of the lovely and retiring violet, than in the grandeur of the majestic oak which braved the tempest for a thousand years; no less in the structure and organism of the smallest infusoria than in the massiveness and strength of the monstrous whale; no less in the circulation of the blood than in the fixed course of celestial orbs without number.

Let us not imitate those would-be philosophers who, notwithstanding the characteristics of each genus being so strikingly appropriate that they seldom fail to illustrate their perfection even to a superficial observer, have conjured up a number of vague suppositions and gratuitous assumptions about a so-called gradual or progressive perfection of living creatures. Much time has been wasted to discover some plausible ground for a theory at once so futile and so unreasonable. Unable or unwilling to recognize the reasons why some families of birds differ from others in the structure of their limbs, some, wise in their own conceit, have not hesitated to designate as defects the very features which should excite our admiration most. Other investigators of nature, to judge from the manner in which they treat of certain peculiarities, however essential, exhibit a decided preference of some genera to others. It so appeared to the writer in perusing some of the works of the renowned Buffon. Treating of aquatic birds, he writes that: "Of all birds those living in marshes are least favored," and supposes that "having always been attached to the first mire, they could not participate in the progression of other productions of nature, the development of which has been extended and embellished by the care of man; while the inhabitants of swamps have remained in the imperfect state of their brute nature." Not content with thus trying to detract from the perfect work of the Almighty himself, he even finds fault because, unlike other birds, they are incapable of fluttering among the foliage, or alighting on the branches.

The true student of nature will ever be unable to discover flaws or imperfections in any of God's creatures; on the contrary, the more he advances in knowledge, the more he will become convinced of that transcendent wisdom, wherewith everything has been adapted to the uses for which it was intended and of that perfect harmony existing between the shape and structure of the creature and its habits and wants; and he may have discovered, probably long before attaining any remarkable insight into the wonders of animated nature, that the interference of man, far from improving or ameliorating it, frequently tends merely to degeneracy and decay.

OCEAN CURRENTS.

BY J. MANFORD KERR.

The ocean again invites our attention: its movements are the subj consideration.

The movements incident to the waters of the ocean are, (1) waves, (2) (3) currents, and (4) whirlpools. All these various oceanic movements ar duced by distinct and independently-operating causes. Let us direct a mor attention to each separately.

Common waves are the result of the action upon the surface of the wa the atmosphere, the *lower* stratum of which sustains the relation of super- guity to the *upper* stratum of the water; and which, when agitated by v disturbs the equilibrium of the water in proportion to the amount and len continuance of the force exerted—which is the *primum mobile*. The progr undulations thus produced, give the appearance of an onward-flow, bu seeming-flow is illusory. There is nothing more than simply a vertical lation—a raising and falling of the water, except in case of long-continued v storms; in which case there are produced superficial or surface-currents. the upper strata of the water are affected by atmospheric action. At a cor atively small depth—say 100 fathoms—the waters of the ocean are perfectly and tranquil, when the most furious storms that sweep over its bosom are l the surface into crests of sparkling foam.

Every schoolboy knows that tidal waves are produced by the attract the moon, strengthened or inversely modified by that of the sun, according relative positions of these two celestials; that twice each day, or during the in of time that elapses from the departure of the moon from, and return to a meridian—24 hours, 50 minutes and thirty seconds—the ocean ebbs and f that the ebb and flow are much greater in the tropics than towards the because of the greater resistance in the former region to the solar-lunar a tions; that the innumerable islands, coral-reefs, and marine table lands are in iments to tidal phenomena; that the Atlantic, being a narrow meridional is incapacitated by this form and direction for the production of tidal wav any significance; that the seas of the south of Australia form the central nu from which the tidal wave action radiates; that at this centre a large rid water is raised, sent in progressive undulations, westward along the app lunar-solar path, but trending north towards the tropics—the region of the line of celestial attraction, and expends its force in the displacement of m of liquid, which it impells forward in an onward, undulating flow from the of its origin with great velocity.

Currents are of three classes, to-wit: (1) the horizontal-longitudinal c lation, or surface-currents—the result of atmospheric action combined

various other causes (which it is not necessary to expatiate upon in this connection); (2) horizontal-circular circulation, or the lateral circulation in the body of the ocean—occasioned by the rotation of the earth on its axis; and (3), longitudinal-vertical circulation, or the polar-tropical circulation in the body of the ocean—produced by difference of temperature in the polar and tropical regions.

Whirlpools are produced by the meeting, from opposite directions, of two surface-currents. These currents may be either permanent or transitory—tidal or local. Hence, consequent upon this condition of the *prima consæ*, whirlpools are either permanent or transitory. The justly long-celebrated maelstrom off the coast of Norway is caused by the meeting of the tidal currents which flow round the islands of Lofoden and Markoe.

It is manifest on a moment's reflection, that the general cause of the oceanic currents are much modified by the extent, form and position of the oceans. This fact is exemplified in the Atlantic—a long, narrow trough, with free polar communication; the Pacific—a very broad channel in Antarctic regions, and tapering to a width of fifty miles in the region of the Arctic Circle, with obstructed Arctic communication; and the Indian—which is cut off from all northern polar communication whatever. In the Atlantic there is a double-elliptical longitudinal-vertical flow (*vide* figure 2), while in the Pacific and Indian each, there is but a single ellipse; the reasons for this will be given in the sequel.

The accompanying cut (*Fig.* 1) illustrates the horizontal circular flow. In this cut all minor movements are discarded in order to be enabled to give due prominence to this one movement, and that without confusion.

W. E. represents the equator; the parallels 30° and 60° on either side of *W. E.*, the parallels of latitude so named; the arrows indicate the direction of the flow of the currents.

In either tropic there is a current sets *from the east*, and in the higher temperate latitudes one *from the west.* These currents turn into each other in the tropics, making a double-elliptical flow. This passage of tropical water into extra-tropical regions may occur in all longitudes, but it is discernable only in lateral regions.

A portion of the extra-tropical current flows out into the polar regions at *A*, the main portion of which returns from thence with the polar inflow in current *B*, along the western side of the oceanic basin; the remainder continues its easterly-flowing course and returns in current *C*, along the eastern portion of the ocean's basin.

The current *B* is mainly from the polar latitudes; the current *C* is principally from the higher temperate latitudes, being the extra-tropical offshoot in its easterly return to the ellipse.

These current-flows may be explained as follows:

As the earth rotates to the eastward, the westward tropical flow is due simply to a slight lagging of the waters in these latitudes. But in the polar

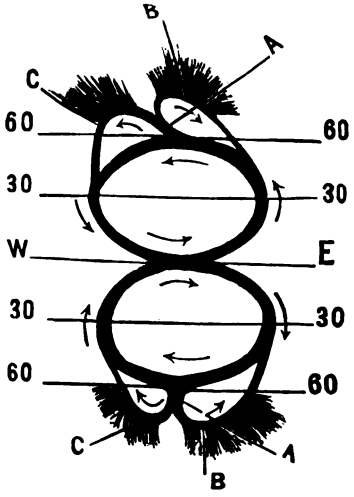


FIG. 1.

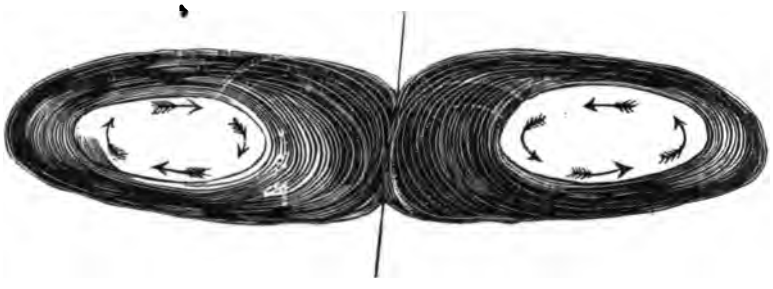


FIG. 2.

latitudes, where the earth's surface moves less rapidly (for, as Dana sa rate of motion varies with the cosine of latitude), the waters flow more r than the surface of the earth moves, which necessarily gives them a curr *eastward*; yet the rotation of the earth is not considered to be the *p mobile* of these movements in the water; but there being already a moven because of reasons upon which it is not necessary to dilate in this c tion—from the equator towards the poles, and from the higher latitudes t the equator, this rotation *gives easting* to the flow from the equator towar poles, and *westing* to the polar-tropical flow. Consequently any waters fl from the polar regions towards the tropics will be thrown against the *w* of the ocean, because of their incapacity—coming as they do from latitu which the rate of motion of the earth's surface is so low—to keep pace wi earth's motion as they approach equatorial latitudes. But waters fl towards the poles, in which the eastward-moving force has not been abate descend to lower latitudes along the eastern side of the ocean.

Fig. 2 represents the longitudinal-vertical circulation. The *primum m* this flow is difference of temperature.

It is generally known that *fresh* water *contracts*, thereby increasi density and specific gravity, as it cools from any high temperature do 39.2° Fahr.; then it *expands* again, thereby diminishing its density and s gravity, as its temperature is reduced from this to 32°, its freezing poi has been ascertained that just before fresh water freezes it has the same d (or rarity rather) that it had at 46.4°.

With *sea*-water, however, it is quite different. Marcet and Despertz satisfactorily, if not incontrovertibly, shown that sea-water continues to co and consequently to become heavier, as its temperature is reduced fro deg. to its freezing point, which is 27 deg., or lower. From this fact it f that on sea-water, in the process of congealation, a cold film would form film being heavier, bulk for bulk, than the water immediately beneath, it sink. Now, if the polar seas be *closed*, the *whole* will be reduced to a te ature below 30 deg. But if there be free oceanic communication, sin downward pressure of a column of polar water is necessarily greater tha of a tropical column of equal hight, and the excess of lateral pressure is p tionate to depth, it may be predicted as a *physical necessity*, that there is of the lower stratum of polar water along the bottom of the ocean-basin t the region where the elevation of temperature makes the column of least d It is patent that this under-current from the polar to the tropical regio necessarily produce a depression in the polar surface-level. To supp deficiency thus created, an indraught from the tropics into the polar regio be produced; and this indraught to supply the deficiency occasioned l continued out-flow of the under-current, can only be maintained by a g movement of the upper stratum of the equatorial portion of the ocean. Th ical water thus drawn into polar regions, will in turn be condensed, des the bottom, and be carried back into the tropical regions by the polar u currents.

These movements are incident to the ocean (Atlantic) on either side of the equator. The under-currents from either pole meet at or near the equator, there rise to the surface to replace the upper stratum drawn off by polar-indraught, and be re-subjected to solar heat and poleward movement. The glacial waters which descend, through the influence of polar cold, in the Arctic and Antarctic basins, rise to the surface wherever and whenever the weight of the superincumbent column is diminished by the elevation of the temperature. When it reaches the surface it is re-subjected to solar heat, and is brought again, by the polar-indraught, under the influence of polar cold, thus keeping up a continual longitudinal-vertical circulation. These polar under-currents turn into each other a trifle north of the equator, and thus form ovate-oblongs, attached at their broad ends. The latitude of attachment, however, is not constant. Being dependent upon *heat*, as the sun—from whence emanates the influencive heat—travels north or south of the equator, the latitude of attachment moves accordingly. This latitude is always a trifle to the north of the solar path. The reason of this is, the Antarctic under-current, being much stronger than the Arctic one, it is projected beyond the equator.

The various causes of ocean-currents have long and successfully baffled the penetrative powers of man; nor is it definitely certain that he is at present acquainted with *all* the immediate and ultimate causes of oceanic movements. Quite an amount of light has been thrown upon this subject by the scientific exploring expeditions of the "Porcupine," the "Tuscarora," and the "Challenger." The latter is at present engaged in a scientific circum-navigatory expedition, which, from the time of setting out, will require two years for its completion.

It is not our purpose to recount here *all* the results of these various expeditions, but only such as have a bearing, direct or indirect, upon the determination of the subject under consideration. Besides the information collected respecting oceanic currents, no small amount has been obtained respecting oceanic temperature; and the knowledge obtained respecting the biological condition of the abysmal depths of the ocean is not of inferior interest and importance.

The remarkable success of the short scientific cruise of the "Lightning," in the fall of 1868, induced the British Admiralty, for the furtherance of scientific interest, and the promotion of scientific investigation, to place the "Porcupine" under the charge of J. W. Thompson, J. G. Jeffries and Wm. B. Carpenter. They made two expeditions: one in 1869, and one in 1870.

Before proceeding to give the results of these expeditions, probably it would be well for us to devote a paragraph to a review of the state of knowledge upon this subject, prior to these expeditions.

The French circumnavigator, D'Urille, promulgated and maintained the doctrine that the temperature of the surface of the ocean depends upon the temperature of the lower stratum of the superincumbent atmosphere, except when currents from a warmer or colder region transports to a given portion of the ocean a body of warmer or colder water; that the *body* of the ocean is not

subject to the influence of surface-temperature—this influence extending (few fathoms below the surface of the water—but that at any considerable the temperature is everywhere 39 deg.; that when the thermometer is su the equatorial regions, the mercury gradually, but progressively, falls t point from a surface temperature of 75 or 80 deg.; and that when sunk polar seas, it gradually, but progressively, rises to that point, after the surface-stratum has been passed; and that there is a place somewhere be the poles and the equator where the temperature is 39 deg. from the surf the bottom. The lower temperature that was sometimes met with in de soundings was attributed to local polar-currents.

This theory was supported by the thermometric observations of Sir Ross, (who was a disciple of M. D'Urville,) made during his Arctic voyage accepted by Sir John Herschel, endorsed by the most eminent scientists time, and adopted by all physical geographers. For a long time this theo supreme sway upon this subject, throughout the realm of science; and to d from it was stigmatized as heresy.

When the theory of M. D'Urville respecting the uniformity of the de temperature was first given publicity, and was gaining the credence and re the support of the leading scientists of the day, Professor Lenz, of St. Peter one of the most eminent physicists of his time, contravened it with concl based upon facts obtained by various experiments made by Professor Parr himself, for the purpose of ascertaining the temperature and specific g at various depths, of the waters of the ocean. These experiments were during the second circumnavigatory voyage of Kotzehue, in the years 1 These conclusions, as given by Dr. Carpenter in the *Contemporary Revie* as follows:

1. That the coldness of the bottom-water of the great ocean-basins ind the existence of a general underflow of glacial water from the polar areas to the equator.

2. That the existence, at and near the equator, of a band of water b the surface, which is much *colder* than the water at similar depths betwe tropics, (as shown by the *rise* of the bathymetrical isotherms in passing either tropic towards the equator,) can only be accounted for by *a co ascent of polar water from the bottom;* such an ascent being further indicat the moderation of the surface-temperature of the equatorial oceans, and l slow salinity of equatorial surface-water, as compared with that of the tr surface-water.

3. That a movement of the upper stratum of the oceanic water fro equatorial region towards either pole, is the necessary compliment of the u flow of polar water.

4. That this double movement is maintained by the constantly-re disturbance of equilibrium produced in the water of the great oceanic by polar cold and equatorial heat.

Immediately upon the promulgation of this theory of Professor Lenz, it sank back into the oblivion out of which it been drawn, for want of adherents. His deductions, which gave the first publicity to this theory, were based on personal observations and experiments made during the second circumnavigatory voyage of Kotzehue, and made their appearance in the *Bulletin* of the St. Petersburg Academy, in 1847. Notwithstanding the high authority from which they emanated, these deductions attracted but very little attention, so completely was the scientific world infatuated by the theory propounded by M. D'Urville, and maintained by Sir John Herschel. In fact it seems to have been altogether forgotten until Professor Priestwich rescued it from the oblivion of eternity, and re-thrust it upon the attention of the scientific world.

Strange though it may appear, it is nevertheless true, that the investigations of Dr. Carpenter upon this subject led him to conclusions identical with those of Professor Lenz. Dr. Carpenter professes profound ignorance of the existence of these deductions of Professor Lenz until they were pointed out to him by Professor Priestwich. This has been questioned, unjustly we think, by some. How it may in reality be we do not know positively, and shall make no efforts to determine. We cordially and reliantly accept the statement of Dr. Carpenter. We see no reason why it should be questioned. This is not the first time identical results have been obtained by independent investigators. One of the most marvelous instances of identical results is that of Wallace and Darwin. They conducted their investigations upon opposite sides of the world, neither knowing anything about the investigations of the other, and astonished the world, and horrified some of the over-zealous who are swift to denounce every new revelation in physical science as contravening the plain and unmistakable teachings of the Bible, with a simultaneous promulgation of an identical theory—that of *Natural Selection*. In the present instance we are not concerned so much about the paternity of the theory as about the theory itself. The only questions that can be pertinently asked are: Is this theory rational? Is it founded upon, and borne out by, well authenticated facts? We will see.

By the modern method of deep-sea exploration the depths of those areas which have been carefully examined are known with almost as much exactness as are the heights of the various mountain ranges, and the altitudes of the numerous isolated peaks of the different Continents. And we are familiar with the various temperatures at different depths, in a given locality of the explored deep, as we are with the climate of a given section of country, or the temperature of a given altitude.

The first thing to be ascertained, in the explorations of what is denominated the "fathomless abysses" of the ocean, is depth. This may be done with an ordinary "lead and line," when the depth does not exceed a few hundred fathoms; and the line does not meet with a surface-current, or an inter-oceanic movement, and it can be relied upon. But if the depth extends to thousands of fathoms, or oceanic movements are met with, the results obtained are ex-

tremely unreliable. Modern investigations have shown that those old sou which indicated a depth of from six to eight miles, and more particularly which represented the ocean as absolutely unfathomable, are incorrect.

If in a given section the oceanic basin is smooth, or comparatively water of said section will be subject to all the oceanic movements—deep s surface—although it may not attain the maximum depth; provided alw depth is not reduced to the minimum below the stratum influenced by c and seasonal variations; but if it be rugged these movements will be im and the submarine protuberances may be so prominent as to cut off these ments entirely. Take as an illustration the Mediterranean Sea. From oceanic movement (except a minor surface in-flow and an under c through the Strait of Gibraltar) are cut off, and we do not find *any* of th minent characteristics of the open ocean, either in temperature or moven

The Mediterranean consists of two basins, known respectively Western and Eastern basin. The former attains, between Sardinia a Balearic Islands, its maximum depth, 1,600 fathoms; the latter a ma depth of 2,000 fathoms, between Malta and Crete. M. Aime, who m examination of the Western basin, published the result of said examinat the *Annales de Cimie* (Tome XV.), in 1845, in which he showed conclu that the waters of the Mediterranean are subject to two variations, t 1. *Diurnal variations*, which are limited to a very thin surface stratum; *Seasonal variations*, which have a much deeper range than the former, bu also are limited to the upper plane, in no case exceeding 100 fathoms in Beyond the waters subject to the influence of seasonal variations, the *te ture is uniform all the year round;* not only this, but it is also *uniform f top to the bottom of the basin.*

Dr. Carpenter's investigations were extended to both basins, with t lowing results: In the Western basin, while passing through a surface-s of about fifty fathoms in thickness, the temperature fell rapidly from 77° than 57°; from this to the depth of 100 fathoms there was a gradual red in the temperature to 55.5°; and from thence to the bottom (1,500 fa there was a reduction of but 5°, the bottom temperature being 55°. Eastern basin, because of its more complete isolation from all extra-c influences, and its nearer proximity to the equator by 3° or 4° of latitud influence of solar radiation extends much deeper. The surface-stratu reduced from a surface temperature of 79° to 58.5° at the depth of 100 fat in the next 200 fathoms there was a reduction of 1.5°; throughout t maining 1,700 fathoms the temperature was uniform at nearly 57°.

The Red Sea furnishes a similar illustration. It has no commun with the Arabian Gulf (which is subject to the temperature-modifying inf of polar cold, imported by the Antarctic under-flow), except throu shallow strait of Babel Mandeb, and is consequently cut off from all the ences of inter-oceanic circulation. The surface-temperature has been to reach 90°; but the superheated surface-stratum is limited. In the mo

February Captain Nares found the temperature of the Suez Gulf uniform at 71° from top to bottom, 450 fathoms).

The researches of the "Challenger" expedition have disclosed several instances of the same class of seas in the Indian Archipelago. The bottom of the basin in this region presents remarkable local depressions, which are frequently almost entirely cut off by submarine water-sheds from the circumambient oceanic waters. Of these the Sulu Sea—which sustains the same relation to the China Sea that the Mediterranean Sea does to the Atlantic Ocean, or the Red Sea does to the Arabian Gulf—the seclusion is the most complete. In it we find a uniform temperature of 50.5°, obtaining from 400 fathoms to the bottom—2,550 fathoms. Since this temperature is met with in the adjoining China Sea, and Celebez Sea, at the depth of 200 fathoms, or less, and in the Atlantic Ocean at a depth of 230 fathoms, we are warranted in concluding that the reefs and barrier-ridges, which are known to enclose this extraordinary "pot-hole," have *not* their continuity broken up by any deep-sea "openings."

In the Celebez Sea the temperature, from a depth of 100 fathoms to the bottom (2,600 fathoms) is uniform at 38.5°. In the waters of the Indian Ocean, on one side, and the Pacific Ocean on the other, the bottom-temperature is 25°, showing that the bottom (1,900 fathoms) of this sea is entirely cut off from all communication with the waters which occupy the adjacent oceanic basins; and in the Banda Sea there is a uniform temperature of 37.5° from 200 fathoms beneath the surface to the bottom (2,800), showing that the barrier which prevents the inflow of cold water protrudes surface-wards 1,200 fathoms.

The recent explorations of Captain Chimms in the Indian Ocean, reveal the remarkable fact that nearly under the equator the surface-temperature is 85°, and in passing through an upper stratum of only 150 fathoms the temperature falls to 54°; that from thence to 750 fathoms it falls 2°–|– for every 100 fathoms passed through, making the temperature of this depth 40.033°–|–; and that from this depth to the bottom (2,656 fathoms) there is a more gradual reduction to 32°.

These examples are amply sufficient to establish the before quasi-patent fact that surface-heat or surface-cold and depth, *per se*, are not the *vera causa* of deep-sea temperature.

Let us not follow the course the "Challenger" in the Atlantic exploration, noting a few of the most prominent results of the investigations of this expedition. These explorations extended over an area of about 15,000,000 square miles—that which is embraced within the parallels of 38° either side of the equator—and showed an average depth of from 2,000 to 2,500 fathoms. There were but few abrupt inequalities met with, except in areas where local volcanic upheavals have thrown up islands and raised the bottom of the oceanic basin in their vicinity. Results of this action are met with in the Azores, Madeiras, Canaries, Cape Verdes, St. Helena, Tristan d'Acunha, and Ferando Noranha.

It must be remembered that the Atlantic basin is a depressed longitudinal area comparatively free from obstructions (submerged table-lands, submarine

water-sheds, and surface-ward protruding barriers) with free Antarctic com cation, and a more or less obstructed communication with the Arctic re also that it gradually widens from the equator towards the Antarctic r with the receding of the coasts of Africa and South America, but progre contracts from the equator to the Arctic Circle, and communicates wi Arctic regions through the narrow channel-passage between Iceland and G land. This peculiarity of form is of special significance in determining sea temperature. The strong Antarctic glacial underflow, meeting wi material impediment, (the weak Arctic underflow—weak it necessarily cause the narrow passage referred to has not the capacity to convey a suf quantity of Arctic water to produce a very strong current—would interp very material obstacle,) is projected some distance beyond the equator demonstrated by the results of the temperature-soundings, which indi difference in temperature of 1.1° (N. 34.4° and S. 35.5°.)

Form and position of basin are material elements in the determinat longitudinal-vertical circulation. The Atlantic basin being a narrow long nal, southward-flaring canal, in communication with either Polar Sea, wi sent the phenomenon of longitudinal vertical circulation (*vide* Fig. 2). Pacific Ocean being *almost* entirely cut off from all Arctic communicatio that which it has being limited, by the narrowness and shallowness of B Strait, to an insignificant surface-flow, possesses but one of the ovate-ol incident to a perfect longitudinal-vertical circulation. But more particul this true of the Indian Ocean, which is deprived of *all* Arctic communic In each of these oceans the flow of the Antarctic ovate-oblong is very s forcing the southern glacial water into northern latitudes. That of the I Ocean carries into the Arabian Gulf water not many degrees above the fr point, and spreads all over its equatorial region a substratum of a yet temperature.

This same cause, operating in the southern Pacific, carries the Ant glacial water far into northern latitudes. In the Atlantic, it is the caus reduces the temperature of the basin south of the equator more than a lower than that of the water in the same latitudes north of the equator.

In this longitudinal-vertical circulation we are enabled to see a new festation of the wisdom of that Providence who never made anything in We may not be able to discover all the purposes this circulation was int to subserve, but we have already been made acquainted with very imp offices it performs, to-wit: (1) to ærate the water and render animal exi possible; (2) to carry food for the sustenance of animals into the al depths of the ocean, and (3) a distribution of, and maintenance of o temperature, alike surface and bottom-temperature. This distribution of perature is one of the principal agents that dominates the distribution of o animal life.

On this point it has been aptly remarked that the influence of this o movement "in providing the inhabitance of the abyssal waters with bot

and oxygen is not one whit less important" than its service in ærating the water and regulating the distribution and uniformity of temperature; "the condition of a deep inland sea (such as the Mediterranean), which is virtually cut off from its influence, being one of such stagnation as to be incompatible with the existence of animal life at any great distance beneath the surface. There is no reason to suppose that animal life could exist on the ocean-bottom at depths far exceeding that of the barren sea-bed of the Mediterranean, if it were not for the vertical movement produced by opposition of temperature; which, by bringing up every drop of ocean-water, in its turn, from the deepest abysses to the surface, purifies it from the carbonic acid and other products of animal decomposition with which it has come to be charged, imparts to it a vivifying dose of oxygen, and mingles with it those products of vegetable life, which serve, when carried down to the ocean-depths, for the nutrition of the animals that swarm upon their bottom, and contribute, by the accumulation of their *exuviæ*, to form the components of future continents."

THE QUESTION OF THE DAY.

AN ADDRESS DELIVERED BEFORE THE WESTMINSTER LITERARY SOCIETY BY W. C. CHAPMAN, M.D.

If we are able to judge of the inhabitants of past ages of the world by the form of thought displayed in the literature of the times, there will be no reason for any uncertainty in the minds, of those who follow us, in determining the leading, it might be said the all-absorbing, thought of those who are now investigating the complex questions involved in an exhaustive study of nature, and the laws which govern the universe. The great minds of the world are endeavoring to solve the problems presented on every hand, and which, for the time at least, lie apparently beyond the grasp of human intellect.

At no time has there been such a wide-spread endeavor to understand the relations existing between the various forms of matter; or between the mind of man and his acknowledged material body; or, above all, the relation of the universe to an Almighty God. It is possible, at our age of the world, to fully discuss the questions involved in a consideration of all subjects connected with these various topics, with none to molest or make afraid; and there is no fear that anything but good to ourselves and posterity can eventually result from this turning and overturning of the momentous questions under discussion.

In former times to declare the rotundity of the earth condemned such an one to severest punishment; and Galileo, in his seventieth year, was inside the walls of a prison, because he declared the earth revolved around the sun. Let us hope that these times of bigotry have forever passed away, and that no endeavor will ever again be made to prevent the full expression of the views of those who perhaps may differ with many who are considered "orthodox."

If one who had slept for twenty years should suddenly (as Rip Winkle) awake, and endeavor to read intelligently our modern literatu would be at a loss to understand the meaning of all this commotion— where would he see conspicuously "Conflict of Science and Religion. would reason within himself and say, "When I went to sleep everythin quietly along; there was no conflict then. I was taught to believe th Almighty governed the universe, and that I had been created for His hon glory. Now I cannot say whether I am myself, as God intended me, or w I should be down among the tadpoles; or, just having cast off my tail, be allowed to associate with the more advanced society of the bull-frog."

The question I would briefly discuss to-night is whether in reality t any conflict between true religion and true science. I make this disti true for there are many scientists, falsely so-called, as well as false profes religion, who would endeavor to wage war against each other by pres views not held by those who certainly are best informed, and in whose d strations of the truth all can rely.

To some theologians the very name scientist conveys the impression who has neither the fear of God or man before his eyes, who persistent at naught the teachings of the inspired word of God, and who even disca Almighty overruling Providence. On the other hand to some scienti name theology implies all that is born of absurdity and superstition, ar theologian is at once a bigot and a hypocrite. It should be the duty of a desire to benefit mankind, to endeavor to show where such opinions are cious, and that in reality, there is nothing that can be presented by the sc which is demonstrable as the truth, which may not at the same time be ac by the most rigid theologian.

Thus beautifully does a late writer express the idea which we ha deavored to convey: "This recent cry or the 'Conflict of Religion and S is fallacious, and mischievous to the interests of both science and religion would be most mournful if we did not believe that, in the very nature of t it must be ephemeral. Its genesis is to be traced to the weak foolishn some professors of religion, and to the weak wickedness of some profes science. No man of powerful and healthy mind, who is devout, ever h slightest apprehension that any advancement of science can shake the dations of that faith which is necessary to salvation. No man of powerf healthy mind, engaged in observing, recording and classifying facts, searching among them for those identities and differences which point t ciples and indicate laws, ever feels that he suffers any embarrassm limitations in his studies by the most reverent love he can have for God Father, or the most tender sympathy he can have for man as his brother, hatred for sin which produces penitence, or that constant leaning of his on God which produces spiritual-mindedness, or that hope of a state of i tal holiness which has been the ideal of humanity in all ages."

It is the boast of the scientist, that he accepts nothing which does not

of proof, that before he believes any statement to be a fact, it must be clearly demonstrated to him, and it should in no wise conflict with laws which have been previously established. I would here ask the question, are we of this age the only scientists that have ever lived? Surely the ideas held by our fathers only a few years ago, were as truly accepted by them, and as clearly proven to their minds, as are the late ones to our own, and still in many cases they were diametrically opposite to the now accepted opinions. Every-day experience goes to show that many of the ideas which have been held as correct, must totally fall to pieces when viewed by the light of further investigation. It matters not in what direction we look. Chemistry, physiology, geology, astronomy, or each and all of the various scientific fields of observation, have changed and are changing so much day by day that the text book written twenty years ago is considered so far behind the times, as to be worthless even in a primary school.

What right, I would ask, has science to presume that in her assumptions she stands correct, and that those who differ with her, are therefore always in the wrong? Even now, there are so many schools of scientists opposed to each other, in so many ways, that it would be impossible for one who would follow true scientific leadings, to enroll under the banner of either. It is well known that bitter feuds, and unreconcilable differences exist among these various scientific brethren, and if these cannot harmonize, who are supposed to pin their faith upon purely demonstrable facts, what can be expected of us who must follow and cannot lead, and are expected to accept the edicts of science, because some one who presumes to scientific learning says to us they are clearly demonstrated.

I care not what scientific study you or I may endeavor to pursue, there is always a certain amount of recognized truth which must be taken as fact, that can never be proven as such, by any train of logical reasoning.

Take first, if you please, the science of mathematics, the one science that is always brought forward as an exponent of scientific exactness, are all its rules demonstrable? It can be shown conclusively that two added to two will always amount to four, but can any one prove an axiom, a "self-evident truth," so it is; but, I ask the question, can you prove to any mind, by word or illustration, the accepted definition of any one of these truths which are received by the understanding, without a question, although not one has been logically demonstrated.

Chemistry, a science, which to fully comprehend must be investigated, with mathematical accuracy, presents many questions which have never yet been proven to be realities.. Physicists are frequently propounding the question, "are the elements elementary?" and are doubtful whether the sixty-three so-called elements will not be so reduced in number, by future analysis, as to be represented by but two or three simple substances. We call the black substance from which our lead pencils are made, graphite, and consider it almost pure carbon. Science has not been able, by analysis, to discover in what way it

differs from the diamond, the rarest and most beautiful of gems. In our tific infancy we call them chemically the same, although to the organs o mon sense they differ in all respects. Time will surely show in what r they differ.

We have of late years come to understand that light and heat are n once believed, material in character, but merely modes of motion trans through a medium, called ether, pervading all space. We have even be to accurately measure the waves thus set in motion and comput oscillations.

We have been able to weigh an atom of matter, and determine the r of its combination with atoms of unlike substances. Yet no one h applied to it the rules of mensuration. From these infinitely small parti matter, simple or compound, we have formed all inorganic or organic subs The atom thus representing the ultimate division of which all matter is c

Astronomy, with just pride, points to the evidences in the heavens t pursues her investigations in a field where she can show to the world t laws are unchangeable. I never stand with my face to the sun, and—pain might say—wait for the instant when the moon shall begin her journey ac face, (foretold, years before, by the astromomers' calculations,) without praise and glory and honor to the Almighty, who, while able to hold the s in their places, has also given the ability to man to calculate and forec events, which are certain to occur as time rolls on.

In this branch of science, while much has certainly been proven there remains much to be known only by the investigations of the future. hosts of telescopes, both great and small, have been brought to bear u comet's tail. Some observers have shown it to be composed of solid pa others that they are clouds of gases. Some have supposed that by a sw this tail the world and all thereon would be hurled from its orbit int while others presume to know that if such a collision should oc would not be noticed more than a passing summer zephyr. There com now who shows that the comet's train is nothing more than its own s illuminated by the sun.

It was astronomy that gave to the world the "Nebular Hypothesis" great stumbling-block that stands in the way, and turns the world upside in the great scientific and religious discussions now going forward. Darwin and Huxley have endeavored to prove in the animate world, as the origin and descent of all living species, so have Kant and Hersc Tyndal endeavored to show that inanimate nature, as well, has develope one primary nebulous condition.

Let me briefly state the idea conveyed by a study of this "N Hypothesis." By scientific examination it is found that the bright pat light, which are to be seen, like small, ill-defined clouds, scattered over portions of the sky, are formed of vast masses of incandescent gases, or of ignited solids. Reasoning from this proven fact, scientists believe tha

are but the beginnings of worlds like ours; that the earth and the whole solar system was, at one time in its history, an incandescent gaseous cloud. As an able writer (Draper) says: "It may, therefore, be admitted that physical evidence has at length been obtained demonstrating the existence of vast masses of matter in a gaseous condition and at a temperature of incandescence. The hypothesis of La Place has thus a firm basis. In such a nebular mass cooling by radiation is a necessary incident, and condensation and rotation the inevitable results. There may be a separation of rings, all lying in one plane, a generation of planets and satellites, all rotating alike, a central sun and engirdling globes. From a chaotic mass, through the operation of natural laws, an organized system has been produced. An integration of matter into worlds has taken place through a decline of heat."

It is not the purpose of these remarks to consider the question of spontaneous generation, or especially to present the views of those who consider that the world and every form of life existing in the world have developed from primordeal germs, through various changes, from a common beginning. I would as clearly and briefly as possible endeavor to convey to your minds the fact that science is now endeavoring to determine the *laws* alone which govern the universe; that the supposed conflict arises from the attempts of those who are *theorists*, only, and who endeavor to investigate in directions which are as far beyond the reach of human intellect as are the thoughts of space, or an eternity with no beginning or no ending.

The true theologian—one free from all superstitious absurdities—has no conflict to wage against one who interprets nature's laws: he stands ready with heart and hand to assist in disseminating the truth, and recognizes the hand of the Almighty, who in the beginning created all things. Let either the scientist or theologian ignore or deny the existence of an Almighty Cause, if you so choose to call it, and he is found drifting sailless and rudderless into the depths of an unknowable sea.

There are certain laws which govern the existence of all things. Not the faintest beam of light strikes upon the human retina without obeying a score of laws which can never be violated. Not the faintest whisper is conveyed to the ear, and does its work, without observing all of nature's requirements.

Almighty God is in no wise less reverently worshiped because we find that His law rules everywhere. And that the same laws which were impassed upon all nature on creation's morn are still the same that control its changes now. I see no less God's hand in all around because He does not interpose and work a miracle to demonstrate His power,

"We have often witnessed," (says Draper,) "the formation of a cloud in a serene sky. A hazy point barely perceptible—a little wreath of mist—increases in volume, and becomes darker and denser, until it obscures a large portion of the heavens. It throws itself into fantastic shapes, it gathers a glory from the sun, is borne onward by the wind, and, perhaps, as it gradually came, so it gradually disappears, melting away in the untroubled air.

"Now, we say that the little vesicles of which this cloud was composed

arose from the condensation of water-vapor pre-existing in the atmc through reduction of temperature: we show how they assumed the for present We assign optical reasons for the brightness or blackness of the we explain, on mechanical principles, its drifting before the wind; for its pearance we account on the principles of chemistry. It never occurs t invoke the interposition of the Almighty in the production and fashioning fugitive form. We explain all the facts connected with it by physical la perhaps should reverentially hesitate to call into operation the finger of (

When we consider such a scene as I have just read to you; when deavor to fathom the mysteries of cloud formations; aye, truly, when w endeavor to explain the origin of those little vesicles of which the clo fashioned—how mysterious is it all!—we know positively nothing of its We have been able to observe some of the *laws* which govern its prod We know that oxygen and hydrogen, combined under certain circumsta definite proportions, will always produce water. We know, as has be that condensation causes the watery vapor to become visible, or expansio draw it from our view. Separate these gases, and for one of them su another, and we have the atmosphere upon which the cloud is drive follows others of nature's laws. I say this little have we been able to d of nature's laws; but what can we say of the matter from which the clouds are formed? We know of the properties of oxygen, and hydro nitrogen; but who can say what they *are?* They existed before they visible in the cloud, and they exist after they have passed again from sig

Look at this glass of water, pure, and clear and beautiful as crystal God's best and most abundant gifts to man; what can our boasted sc investigation tell us about it? It is called a liquid, and is formed of i gases. We know its taste and temperature; we have studied its physic perties, but has any one discovered from whence it came, and for what p

Scientific observers may rest their belief in a development from a c beginning. The nebulæ may be precursors of worlds; or the primordi may have so developed that, through the mutations of ages, species and v of animate and inanimate objects have so multiplied as to form the wor systems of worlds, which whirl in never-ending circles through space; a what has been proven as to the genesis of this primordial germ, this ne gases? I answer, emphatically, nothing. Admit that there must have beginning, even of a single germ or atom of which a nebular mass is and creation is admitted. That power is none the less omnipotent if beginning such power was displayed in the creation of but an atom of which should by its own laws of being, implanted when created, develop develop until a world was formed in all its beauty. Admit, however, t the most unrelenting scientist must, that even this single germ was creat it is all that any one can ask. The fact of creation being admitted, all for conflict is at an end. Nor reasoning thus can any one conceive of a able to create, which could not as well interpose, and, by a breath, everything before created.

THE WHIP-POOR-WILL.

(*Antrostomus Vociferus.*)

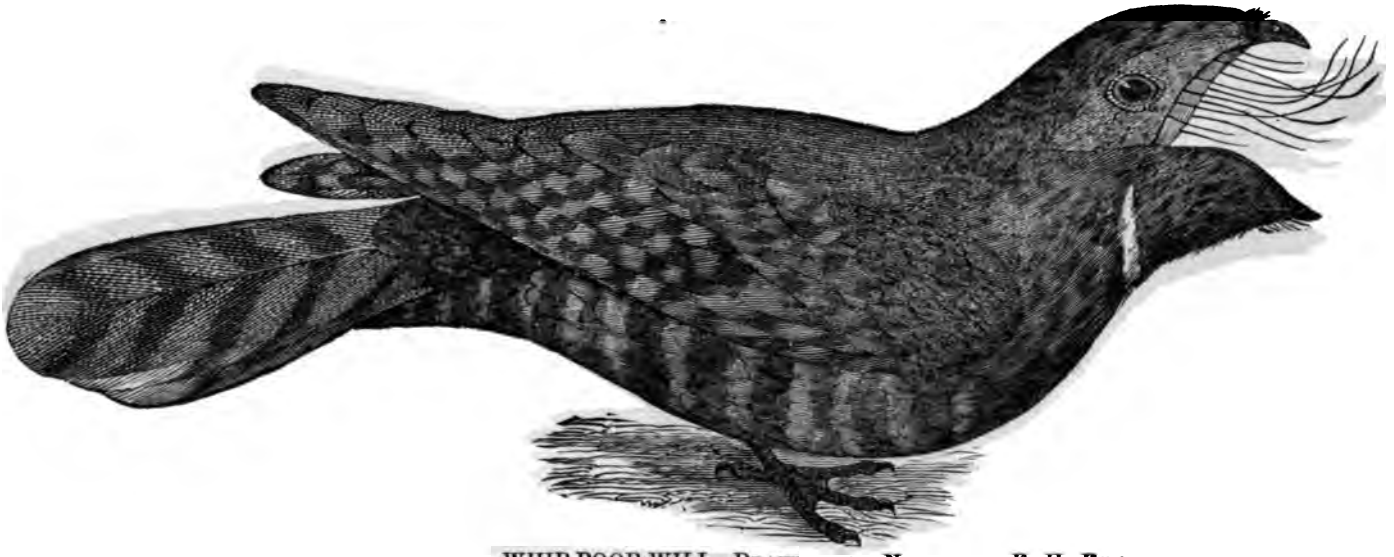
When all nature is hushed in repose and darkness overspreads the land, shrouding hill and vale in obscrurity, every sound has a strange unwonted clearness and startling ring, not common to the broad light of day. There is a mystery and obscurity attached to all nocturnal sounds, that lends a certain charm and interest to the simplest notes. The fall of a nut, the flutter of a leaf, all startle us with unwonted distinctness. The strange, obscure and uncertain light gives uncouth shapes to objects and lends free play to the imagination. This may partially account for the interest that has ever been felt in the Whip-poor-Will. Only seen in the dim obscurity of moonlight, as it flits by on noiseless, spectre-like wing, and generally in the gloomy recesses of the forests, where even at noonday a perpetual twilight reigns, there is a mystery attached to the Whip-poor-Will which, aside from its really clear, melodeous note, excelled by the song of no American bird in clear bell-like melody and pensive melancholy, would excite our interest.

Did you ever wander along the mossy banks of some clear, rippling, sylvan stream, on a moonlight night, where the gliding waters are overshadowed by towering trees, whose limbs are entwined with ivy and grape-vines; where the silvery moonbeams glance between the interlacing canopy of green above, and fall in pearl-like drops of beauty upon the glittering ripples of the stream below. All around is silent like a subdued strange world, seeming a fit abode for fairy forms; familiar objects assuming strange fantastic shapes in the uncertain light; the hush of nature is broken by no sound, save now and then the chirp of the cricket, or the sigh of the summer breeze. But, hark! This dreamy silence is now broken by a clear, mellow, and sweet bell-like note, which rings out upon the midnight air, echoing through the forest aisles, and compelling one to rapt attention—'tis the note of the Whip-poor-Will, one of the most interesting of the many strange inhabitants of our forests and groves.

The Whip-poor-Will inhabits all of eastern North America, from Guatemala to about 56° north. Its western range extends to the great plains, breeding throughout most of its territory in the United States, and wintering from the Gulf of Mexico south. At Pembina, on the Red River of the north, it is very common in summer, where it also breeds.

The Whip-poor-Will makes no nest, but lays its eggs (which are two in number) upon a few dry leaves, on the ground generally, near some old stump or fallen tree, always in a dry place, usually upon some little knoll facing the south. The eggs are white, thickly marked with scratches, wavy lines, spots, and blotches of brown and purple. They are elliptical, quite equal at both ends, and are 1.25 long by 0.85 wide.

This bird first arrives from the south, in the Gulf States, early in March, and gradually moves northwards, arriving in Ohio in the middle of April,



WHIP-POOR-WILL.—Drawn from Nature by E. H. Fitch.

appearing in New York and New England about the 10th of May, again for the south the latter part of September. Its note has been he Wisconsin as late as the 20th of September.

In habits the Whip-poor-Will is strictly nocturnal, keeping closel cealed within the recesses of dark woods during the day, where it r perfectly silent, sleeping most of the time, uttering no note even if dist In very cloudy weather, late in the day, Whip-poor-Wills may occasion seen flying after insects, but this is not usual, and they utter no sound t quite dark.

The flight of this species is smooth, noiseless, and buoyant, but rare tended far at a time. Being exceedingly shy, it is easily startled if appro and if frequently disturbed is apt to forsake the locality.

As soon as twilight disappears, and the shades of night fall like a pa the landscape, these birds issue from their retreats and fly out into mor spaces in pursuit of their insect food. Upon the appearance of the moo song may be heard from fence and bough, for they never utter a note flying.

The food of this bird consists of moths, beetles, and other noc insects, which it captures in its mouth while flying. For this purpo opening of the mouth is very large, and lined on each side with man hairs, which extend more than an inch beyond the end of the bill, form admirable insect trap.

A curious fact in relation to this species is that should the eggs or be visited and handled the bird removes them, one by one, in its mout distant and safer locality. When surprised upon its nest the Whip-poo resorts to various and ingenious devices to attract the attention of the in from its young or eggs to itself. It flutters along the ground as though wo or in great distress, beating the earth with its wings as if unable to aris tumbling about on the grass apparently in the greatest fear and d Should she succeed in enticing one to follow her she will lead him awa satisfied that he is at a safe distance from her treasures, when she will ari fly back, to the astonishment of her follower, thus risking her own life t her offspring's.

Both parents incubate; the young are hatched in fourteen days, be first perfectly helpless, and covered with a soft down, exactly resembling t leaves upon which they lie. They are fed by their parents a long time they are able to fly. They grow rapidly, being soon able to follow their p and partially take care of themselves, running nimbly about and uttering soft, and mournful note, like Pe-ugh. The eggs are deposited in the So States early in April; in Virginia and southern Pennsylvania in the mid May, and further north not until June. The mother and her tender seldom leave the forests.

One of the most singular facts in relation this strange bird is that it perches lengthwise of the limb or branch upon which it alights, and not

versely like other birds. This may be on account of the small size and weakness of its feet.

The notes of the Whip-poor-Will seem plainly to articulate the words which have been so universally applied to them, *Whip-poor-Will*—the first and last syllables uttered with great emphasis and the whole in about a second to each repetition. When two or more males meet, the Whip-poor-Will altercations become much more rapid and incessant, as if each were trying to silence the other. When near you often hear an introductory cluck between the notes. These notes are uttered more frequently in the early morning or late in the evening. Towards midnight they become silent unless it be bright moonlight, when their song may be heard during the entire night.

They fly low, settling on the fence or wood-pile, and skim about only a few feet above the ground in pursuit of their insect prey. When passing, a chattering sound may be heard. During the day they sit upon the ground in the most retired situations, and when disturbed arise within a few feet, sailing slowly and at no great elevation through the woods for thirty or forty yards and then settle upon a low branch or on the ground, there to remain if undisturbed until the shades of night again spread over the land.

The favorite situations for the Whip-poor-Wills are dry and elevated positions in the forest. Swampy or low wet places are not frequented by them, perhaps for this reason: they are scarce along the sea-coast, while quite numerous among the mountains in the interior.

The sight of the Whip-poor-Will appears to be deficient by day, and they are then never seen unless molested, as we have before stated, and from its nocturnal habits and wild, solitary haunts it is seldom seen, and although known by its peculiar note by almost every one, personally it is almost unknown. The aborigines have many strange superstitions in regard to this bird, among whom it figures quite often in their legends and tales; with some being an omen of evil aspect, foreboding death or disease if seen upon the lodge pole at night.

DESCRIPTION OF THE BIRD.

The Whip-poor-will is ten inches long and nineteen in extent; the entire plumage is so mottled, sprinkled, and spotted, as to almost defy description, but we will endeavor, in as few words as possible, to give our readers an idea of the appearance of this bird: Bill black, short triangular; tip of the upper mandible bent down; gonys arched upwards; nostrils tubular. Top of the head and occiput light brownish grey with longitudinal streaks of black; other smaller black streaks radiate from these; back brown, streaked with black; scapulars very light whitish yellow, with two or three black streaks; chin black, streaked with brown; a narrow semi-circle of white on the throat; breast and entire lower parts irregularly mottled and streaked with black and yellow ochre; on the belly the streaks become transverse and assume the shape of bars; the whole upper parts are sprinkled and powdered with minute spots and dots of whitish yellow.

The tail is rounded, consisting of ten feathers, the exterior one on side being one inch and a quarter shorter than the middle pair; the three feathers on each side are blackish brown for half their length, then pure to the tip; the brown portion of the feather is elegantly spotted with re cream color; the exterior tail feather is edged with brown nearly to the four middle tail feathers are brown to the tips, mottled with herring-bone fi of dark brown and light ochre and sprinkled with light ochre spots. W when shut, reach to the middle of the tail, the tail extending two inches be their tips; they are spotted with light and dark brown. Cheeks and sic head brownish orange.

In the female the outer tail feathers instead of being white at the tip brownish cream color; the bar across the throat is brownish ochre; the parts are lighter, minutely and thickly powdered and sprinkled with small er colored dots.

The os hyoides passes up the hind head along the crown, and is atta to the base of the bill on the forehead. The head of this species is wide, flat upon the top; the tarsus is short; middle toe united to the lateral to far as the first joint. The claw on the middle toe is toothed like a comb c inner edge.

COMPARATIVE MEASUREMENTS.

Tarsus shorter than skull; hind toe half as long as bill on top; lateral c do not reach base claw on middle toe; tail shorter than wing; bill one-thi long as head.

DETAILED MEASUREMENTS.

Bill:—

Tip of bill to	forehead	. . . . .	½ inch.
" "	nostrils	. . . . .	⅜ "
" "	corner of mouth	. . . . .	1½ "
" "	outer corner of eye	. . . .	1⅕ "
" "	end of tail (middle feather)	. . .	10 inches.
" "	chin groove	. . . . .	½ inch.

Tarsus, ⅝ inch.
Middle toe, ⅝ 1-16th inch; its claw, ⅜ inch.
Outside toe, 7-16ths inch; its claw, 3-16ths inch.
Inside toe, ⅜ inch; its claw, ⅛ and ⅛ of ⅛ inch.
Hind toe, ¼ inch; its claw, ⅛ and ⅛ of ⅛ inch.

Wing:—

Carpel-joint end,	largest primary	. . . . .	6¼ inch.
" " "	secondaries	. . . . .	4 inches.
" " "	inner tertials	. . . . .	4¼ "

Tail:—

Tail	middle feather	. . . . .	4½ inches l
"	outer "	. . . . .	4 "

The tail extends 2½ inches beyond the upper coverts and 2 inches beyond the lower covers; it also extends ½ inch beyond the end of the longest primary. Second and third wing quills equal and longest; first is ⅝ of an inch shorter than the longest; the fourth is 1⅝ inches shorter than the longest.

Wing Formula :—

First, or outer, ⅝ inch; second and third, equal and longest; fourth, 1⅝ inches; secondaries, 2⅛ inches; tertials, 1¼ inches. Three outer wing quills sinuated on the outer webs.

Diameter of eye, ⅝ inch. The corner of the mouth is beneath the lower corner of the ear and back of the eye. Tarsus feathered in front to within ⅛ of an inch of base of toe; naked behind to knee. There is a short groove (⅛ inch) in front of the nostrils. Middle and lateral toes have a slight emargination on both sides to the base of the claws. Upon the exposed part of the tarsus are three plates. The ear is oblong, its longest diameter placed transversely to the length of the skull; the upper end rounded and largest; the lower obtusely pointed, its length 1 1-16th inches, and its greatest with 1-16th of an inch.

The admirable construction of this bird for the life it is to lead: its soft, lax, owl-like plumage; its wide, ample wings, so well suited for an easy, silent flight; the perfect construction of its mouth for an insect trap, lined with hair to prevent the escape of insects, are only one of thousands of instances strewn before us by the lavish hand of a great and beneficent Creator, exhibiting His wisdom, goodness and love for all His dependant creatures.

THE BERMUDA ISLANDS.

Far out on the broad Atlantic, hundreds of miles from any other land, lies a group of small islets, like mere specks upon the bosom of the ocean. This beautiful and verdant spot—set, as it were, a gem of emerald green on the surface of the blue ocean, where a perpetual summer reigns, and whose surface is variegated with the most charming changes of prospect of hill and dale, islet and water views—is an enticing resort for invalids and pleasure-seekers.

These islands belong to Great Britain, and are situated nearly midway in the Atlantic Ocean, between North America and Europe, being in Latitude 32 deg. 15 min. North, and Longitude 64 deg. 50 min. West, and are 580 miles south-south-east from Cape Hatteras. They consist of three large and about 300 smaller islands, islets and rocks; some so small as to be mere rocks without names or inhabitants. Altogether they are about twenty square miles in area, and contain nearly 12,000 acres. The principal islands are St. George's, 3½ miles long; Bermuda, fifteen miles long; Somerset, three miles long; and Ireland, three miles long. The breadth of these islands varies from two miles to one furlong. The largest, Bermuda, is, in shape, long and narrow, something like a shepherd's crook, being bent round at one end, forming a wide bay.

Among the lesser islands are St. David, Cooper, Smith, Long Bird, and Nonsu
These islets form numerous picturesque bays, inlets and harbors, of great bea
depth and size: such as Great Sound, Castle Harbor and Harrington Sou
The entire group is of coralline formation, being the northernmost spot in
Atlantic where the coral animals are known to work.

The entire grove is surrounded by a reef, through which are many inl
though the channels are somewhat intricate. The climate is simply delightfu
perpetual Spring reigns the entire year. The sky is always clear, and the w
blue and transparent, revealing, to its greatest depths, the many exquisitely va
gated shells that lie upon its pebbly bottom. Snow seldom falls, and not m
rain; but when it does rain it is generally with great violence.* There is a c
stant sea-breeze. Between December and March the thermometer ranges f
60 deg. to 66 deg.; in June from 83 deg. to 86 deg.; and between April
September, from 75 deg. to 79 deg. As the dew point ranges high the ai
always moist. Vegetables of all kinds grow to great perfection, and in ab
dance; besides these, the islands produce maize, fruits and tobacco. P
apples grow in abundance, and are largely exported. Fish abound, and are
excellent quality, forming a branch of industry much followed. There
1,227 acres under tillage, thirty-three acres in grass for fodder, and 10,339 a
in forest or pasture. There are no fresh-water springs upon the islands,
the water used is stored in tanks. The population of the islands, exclusive
the Government troops, convicts and officials, in 1861, was 11,692, of wh
number 6,423 were colored. The principal town and capital is Hamilton,
the largest island; its population is 1,796. The other towns are Tucker's To
on Bermuda Island, and St. George's Town, on St. George's Island.

The Government consists of a Governor appointed by the Crown, a Co
cil of nine members, and an Assembly of thirty-six. There are twelve
and nine private schools. As to religion three-fourths of the inhabitants bel
to the Church of England, which has four clergymen; besides these the Pr
byterians, Wesleyans, and Roman Catholics have one minister each.
convicts are lodged in a large prison, and put to various labors. However, v
few have been sent here of late years.

From the peculiar and irregular shape of the islands, their great num
and small size, and the many large inlets, bays and lagoons, the communica
is almost as necessarily by water as in Venice; and what can one imagin
more delightful than floating between the green diversified islets upon cl
transparent water, with the soft ethereal blue of the heavens over head, w
the gentle sea-breeze fans the cheek and cools the brow. These numerous h
and inlets form many safe and commodious harbors. The harbor of
George's Island is large and deep enough to float the entire United States n
It is fortified and protected by a breakwater.

Geraniums, palmettos, fig-trees, coffee, indigo, tobacco, oranges, lem
bananas, strawberries and peaches grow abundantly, and of excellent qual

* Storms seem to come with the new moon. When the moon appears surrounded by a halo or circle a sto
almost certain to follow, and generally accompanied by thunder and lightning.

while the cactus is found in profusion, which, with its brilliant and elegant flowers, together with the orange blossoms, give a very gay appearance to the scenery.

The town of St. George lies in the hollow of a curve, under a hill; the streets are narrow, and the houses have very small windows. Very few signs are seen on the streets; the people seem to trust to their goods to speak from their shelves only. Walls, houses and fences are built of stone.

The public road from St. George to Hamilton is built by the Government, is as smooth as a floor, and finished as the drives in a park; it winds in and out among the hills which line the shore, and gives glimpses of the wonderfully blue sea, with the foreground of luxuriant vegetation, the distant coral reefs which encircle the islands, and the many islets and mossy rocks studding the pellucid waters like gems in a crystal mirror, while the genial climate adds to the temptation to prolong the ride to an indefinite length, making one loth to go indoors.

St. George's Island lies north-east of the main island. It is nearly as wide as long. Upon this island is the town of St. George, composed of about one thousand houses. Adjoining this is the island of St. David, which supplies the town with butter, milk, vegetables, poultry, and fresh meat. In the bosom of the crook lie a great number of small islands. St. George's Island is rocky and the ground hilly. A continual Spring prevails—cedars, mantled in green, cover the hills: the pasture-ground is always verdant; the gardens ever in bloom; the houses are built of a soft stone, which is quarried upon the islands, and sawn like timber, but when exposed to the weather becomes hard and durable. They are whitewashed with lime from foundation to the ridge of the roof, and are white as snow. When beheld from a distance, contrasted with the greenness of the cedars and pasture-grounds, and surrounded by blooming flowers, the multitude of islands, the larger ones covered with verdure, the small rocks grey or brown with moss, makes a picture of beauty not easily forgotten. The whole island is a continuous village, being thickly settled. St. George's town has a fine library, a very handsome church, and a noble Town House where the Governor and Assembly meet. The whole group is divided into nine parishes, each having its parish church and library.

The Bermuda Islands were discovered in 1522, by a Spaniard, named Juan Bermudas. They were settled by the English in 1607. When first discovered they were absolutely uninhabited. Henry May, an Englishman, was shipwrecked upon St. George's Island, and with cedar which he and his crew felled upon the islands, assisted by the wreck of their own ship, he and his companions, after much labor, built another vessel, in which they sailed to Europe, where they published the news of the fertility of the islands upon which they were lost.

When Lord Delaware was governor of Virginia, Sir Thomas Gates, Sir George Somers and Capt. Newport were appointed to be his deputy-governors; but their ship, becoming separated from the rest of the squadron in a storm, was, in the year 1609, wrecked upon the Bermudas; and the governors, disagreeing among themselves, built each of them a new ship of the cedar they found grow-

ing upon the islands, in which they severally sailed for Virginia. On t arrival there, after a long voyage, they found the colony in such distress Lord Delaware, upon the report made to him by his deputy-governors of plenty found upon the Bermudas, sent Sir George Somers to bring provis from thence back to Virginia, in the same ship which brought him from islands to the colony, and which had not an ounce of iron about her, ex one bolt in the keel. Sir George, after a long and tedious voyage, arrived sa in the Bermudas. But he died soon after his arrival, leaving his name to islands, and directing the crew to return with a cargo of black hogs. But crew, disobeying his orders, sailed for England, where they arrived safely a a very long voyage. Two sailors, Carter and Waters, being apprehensive punishment for their crimes, secreted themselves, however, upon the isla when Sir George was wrecked upon the islands, and had lived there ever si subsisting upon the bounties produced by the soil. Upon the second arriva Sir George, they enticed one Chard to forsake his companions and remain v them. Differing about the sovereignty of the islands, Chard and Waters attac each other in great fury, and were on the point of cutting one another's thro when they were separated and prevented by the prudence of Carter. Soon a in wandering over the islands, in one of the natural valleys, they had the g fortune to find a great piece of ambergris, weighing about eighty pounds, bes many other smaller pieces, which, in those days, would have made each of th a fortune; but where they were it was useless. They, therefore, came to desperate conclusion to sail in an open boat to Virginia, and dispose of t treasure. In the meantime, however, the Virginia colony, claiming the isla sold them to one hundred and twenty persons of their company, who, obtain a charter from King James, fitted out a ship with sixty planters on board settle upon the Bermudas, under the leadership of one Richard Moore. new colony arrived at the islands just as the three sailors were about to dep with their ambergris; which Moor, having discovered, immediately seized disposed of it to the benefit of the new colony. So valuable a booty gave g spirit to the new company, and they immediately set about felling trees building houses, in which they were soon settled. They found many nat productions, a genial climate, and great variety of scenery. Mr. Moore indefatigable in his duty: he built forts, trained the colony in martial du instructed them in laying out gardens and roads. Before his first year expired, a ship arrived from England with many new settlers and provisions. then laid out the present town of St. George. The fame of this new settlen excited the jealousy of Spain, who sent some vessels to attack and destroy colony; but on their appearance they were driven off by the fire from the g of the fort. During the government of Moore the settlers were much troul with rats, which had been brought there in ships, and had become so numer as to cover the ground, and had nests in the trees. They destroyed all the fr and vegetables in the gardens, and finally increased so rapidly that the islan St. George was unable to hold them, and they swam over to the neighbo

islands. This plague lasted five years, when they were finally exterminated. From this time on the colony steadily increased in numbers and prosperity. Moore was succeeded by a Capt. David Tucker, who was a strict disciplinarian, and held all under him to such rigid obedience that five of his subjects, becoming restive, planned and carried out a bold scheme of escape. They, knowing that the governor was deterred from fishing for fear of venturing out to sea in an open boat, proposed to build him a safe and large one, in which, when done, they slyly set sail for England. After almost incredible hardships, being captured and plundered by a French privateer, being reduced to mere skeletons—baffled by storms and tempests—they arrived in Cork, in Ireland, after a passage of forty-two days.

In 1619 Tucker, resigning, was succeeded by Capt. Butler, who brought over five hundred planters as settlers. The colony now numbered one thousand, and from this time on grew until it reached its present state of prosperity.

In conclusion, I would say that no better place for recreation or health can be found: here one enjoys a genial, healthy climate, bracing sea air, and delightful scenery. Several good hotels are found in Hamilton and St. George, the roads are excellent, and the country enticing. The views—as one rides along through the rich, cultivated land, with orange and cedar groves on either side, with blooming flowers in the gardens, the white cottages of the planters, or, now and then, the more pretentious dwelling of some wealthy possessor, peeping out from the green foliage, now and then a glimpse of the blue sea, studded with the numerous green islands—present a scene of great beauty, and long to be remembered.

A line of steamers connects the Bermudas with New York, one to Montreal and one carrying the mails to Liverpool and Nassau. One or two small streams run through the larger island, but the water is brackish. They are crossed by fine bridges.

NATURE'S MUSIC.

"The wind is a musician by birth. We extend a silken thread in the crevices of a window, and the wind finds it and sings over it, and goes up and down the scale upon it, and poor Paginini must go somewhere else for honor, for lo! the wind is performing upon a single string. It tries almost anything on earth to see if there is music in it, it persuades a tone out of the great bell in the tower, when the sexton is at home and asleep; it makes a mournful harp of the giant pines, and it does not disdain to try what sort of a whistle can be made of the humblest chimney in the world. How it will play upon a great tree till every leaf thrills with the note in it, and the wind up the river that runs at its base is a sort of murmuring accompaniment! And what a melody it sings when it gives a concert with a full choir of the waves of the sea, and performs an anthem between the two worlds, that goes up, perhaps, to the stars, which love

music the most and sung it the first. Then how fondly it haunts old hou murmuring under eaves, singing in the halls, opening the old doors witl fingers, and singing a measure of some sad old song around the fireless deserted hearths!"

So writes one of our most eloquent word painters, and has it ever st you how the Creator uses the most humble instruments to beautify and en this fair world, and has filled all the earth with harmony? There is good beauty in every natural object; even the hurricane and tornado, those fe engines of destruction, have not only their uses in purifying and renovating atmosphere, but are accompanied in their terrible onward sweep by the solemn music, for their howl of fierce rage is not altogether without harm Witness how they bring a musical chord as they soar and moan through rigging of the storm-tossed ship, or sweep over the billowy waves as they c in their wild career up and down the lonely waste of waters, lashing the bil into a seething mass of foam, but even here touching a note of deep, sad mony—fit accompaniment to their savage work of devastation—seeming in solemn dirge, each mournful moan, to tell of some life lost, some treasure s to destruction. They sing a deep, continuous bass as they traverse the fo or whistle through the alleys and streets of the city.

Softer chords we find in the rippling brook, as it sings and murmurs kisses the violets and buttercups on its banks, as it pursues its merry, laug way to join its big brother, the river, who himself is not silent, but murmur low, rippling, gurgling song of praise as he lifts his bright waves to gree smiling face of the sun or the soft beams of the moon; whispering to the bles on its banks, toying with the grasses and moss-covered trunks by its ma The ocean is never silent; it has great variety in its voice, now rippling in soft, mellow notes upon the sands, anon thundering in tones of deepest like some great organ, making the very rocks tremble as its grand old swells out upon the world, filling all nature with its splendid anthem of prai the Being who has created and controls all this world.

There is no such thing as absolute silence in nature. There is music e where—sometimes low and mournful, at others echoing in loud and ter tones of thunderous bass, when nature's artillery rumbles in the heavens and lightning's flash shoots athwart the sky, speaking in terrible tones of the p of the Maker of the heavens and the earth. The very rocks, those "sil unchangeable foundations of the earth, respond to the caresses of the win tones of shrill treble or deep bass. Even the silent, lonely desert has t when it awakens from its lethargic sleep and joins the general chorus, and s out its low anthem in response to the call of their ever-persuasive musical le the wind, who seems indeed the director of Nature's choir, and if he doe create all music he often serves to bring the hitherto low notes of the nymphs or sylvan belles into a full chorus of exhilirating sounds. For A loves to wander through the forest glades and arouse all the sylvan dwell tone their harps and awake the echoes from every nook and corner. He tou

each branch and twig, bringing a shrill treble here and a full baritone from yonder giant oak as he sweeps around him, making each tree and bush bend in obesiance as he passes, and arousing every woodland nymph to swell the chorus as he moves on his own course.

Nature is no selfish musician. She does not stop to be urged, but, though often her great performers and the director himself may be silent, yet there are many private performers and solo-singers, so to speak, who sing upon their own responsibility, and mayhap swell the general grand and glorious anthem, yet are not led by this omnipresent and powerful leader, but keep up a small concert of their own, singing in low small voices, of sweetest notes. We refer to the insect world, who, as a rule, conduct their performances and solos without the control of the aforementioned leader. Yet they are often accompanied by the general choir, as the chirp of the cricket is not seldom aided by the soft murmur of the evening zephyrs as they play in low, sweet and melancholy notes among the grand pipes of those natural organs, the pines, or ru stle the leaves of the willow or birch. Among these insect musicians are many fine players; the Katy-did is one of the most noted of the solo-singers, though passionate and unceasing, she seems ever querulous and striving to unravel some hidden mystery. Now, *what is it* that Katy did? Who can tell? There is something very soothing to listen to the quiet chirp of the cricket upon the hearth; or to hear the hum of the busy bee as he wends his way, laden with sweets, to the distant hive. Nature's quiet moods, the small, low voices of her humble creatures, that live and move almost unheeded, seem to have a soothing effect upon the nerves, lifting the mind above the cares of the world, and, for a time at least, taking our thoughts from the trials and vexations of the earth to the humble yet mysterious life around us. Has the reader ever listened, on a still Spring evening, to the full chorus of a mill-pond, when many frogs swell their voices in one grand concert? There is the shrill, sharp, treble and the full sonorous bass, which, at a distance, is not at all unmusical, but gives charm to country life; and when one has been away from his country home and suddenly hears the familiar chorus, how it awakens memories of the absent ones of his dear old homestead; how it carries him back to by-gone days. Though humble, indeed, may be the performers, yet they lend a charm to country life, and fill a void that perhaps few realise, for singly each voice may not be musical, yet, when blended as they are in concert, they are far from inharmonious.

There is another grand army of musicians who play no small or inconspicuous part in the great concert of nature, and who are the very sweetest and best of solo performers. We refer to the birds, who may be compared to the highest of artistic performers among men. As their sweet notes swell upon the air and charm the most obtuse ear, even the night is enlivened by their song. When the rest of nature is hushed in repose, the sweet bell-like note of the Nightingale, or the low, soft trill of the Field-Sparrow, fall in clear, rippling, mellow notes upon the midnight air, like some spirit or fairy being unseen, yet present, to softly soothe and entrance us, and quiet our minds by its thrilling song.

Early in the morning, when the first faint glimmer of light trembles
the horizon, and while the red rays that fringe the eastern portals of the
with a beautiful tremulous motion are fast brightening into a more daz
radiance, we hear from the feathered tribe the commencement of their ge
hymn of praise. There is first an occasional twittering, then a single perf
ance from some more early waker, then a gradual joining of new voices, u
at length, there is a full chorus of song; every few minutes some new s
joins the grand choir, as if aroused by the beginners, and, excited by emula
until the forest and grove rings with thousands of melodious voices. As
sun gains a higher position in the heavens the greater portion of the music
that helped to swell the chorus, discontinue their song, and comparatively
birds sing at noon-day; they are too busy with their household duties.
at night, there is another great choral concert, although not so full or gran
the anthem of morn

So bountiful is nature that every grove, every wood, is filled by t
heavenly musicians. The most common scene is entranced and rendered lo
by their sweet songs and graceful forms, for, united to their voice, they
the most elegant forms, brilliant and varied colors, and graceful motions.
a gifted writer has expressed it: "What shall Heaven be, if God has give
the earth such melodious notes and such heavenly strains?" But the g
Lord of Creation is not niggardly, and his bounties are scattered in a l
way, broad-cast over the earth, and the charms of music are none of the
bountiful of his blessings. They seem to be given at the very best times, v
they can be of the most service.

How soothing of a warm day in summer falls upon the ear the hum of
busy bee, the monotonous note of the grasshopper, or the chirp of the cri
The soft patter of the summer rain, anon arising into a castanet chorus as
wand of the director is waved and the hail-drops fall, the deep diapason of
thunder rolling above, making a fit bass to the chorus of the elements belo

Nature is not selfish, but ever ready to heighten and assist man in
great exploits. When the pilgrim fathers landed on Plymouth's rocky shor
a gifted writer has happily expressed it:

"They shook the depths of the desert's gloom
With their hymns of lofty cheer;
Amidst the storm they sang—
And the stars heard; and the sea,
And the sounding aisles of the dim woods, sang
To the anthems of the free!
The ocean eagle soared
From his nest by the white wave's foam,
And the rocking pines of the forest roared—
This was their welcome home!"

Whether or no there is any sympathy between nature and human feelings
deeds there does, indeed, seem to be a chord of deep magnetic feeling
necting man to the various moods and voices of nature, and the mor
become acquainted with her the more we are prepared to appreciate and e

the bounties and beauties she holds with such a loving, free hand for our use. Music seems to be hid away in nooks and corners where we would perhaps scarce expect to find it. What murmurs of the ocean are found stored up in the sea-shell. Put it to your ear. Listen to the roar of the surf as it beats upon the shore, which tells us of its briny home, long since left behind, in notes both deep and sad; it tells of the moan of the sea-breeze, the sweep of the waves, and the rise and fall of the foam-crested billows, the flight of the sea-gull, and the rise and fall of the tides. In fact we are surrounded by a wonderful world; a world full of lessons of strange, grand and beautiful import; one which we have only to open our eyes and ears to become overwhelmed by the wonderful disclosures. Any person who begins to study the strange and beautiful objects by which this earth is filled begins to live a new, glorious and entrancing life; one which will fill his whole being with new love for the Creator. One grows buoyant with the melody with which nature supplies him; as it were, feels every moral weight fall away from the heart, like Christian's burden, and cannot help lifting his heart in thanksgiving to the beneficent Creator who has placed him in this world so full of beauties and melody.

If we harken attentively to the miscellaneous sounds that come to our ears from the natural world, we shall perceive that some are cheerful and exhilirating, and others possess a melancholy, pensive and depressing effect upon the mind. Of the first class are the sounds produced by the animate world around us; the song of birds, the chirping of insects, and the note of the frogs. The second class comprise chiefly the sounds proceeding from the inanimate world, such as the sigh of the wind, the pattering of the rain upon the roof, the roar of storms, the rush of falling waters, and the ebbing and flow of tides; all these are plaintive in character, sometimes gloomy and sad, often soothing and tranquillising. These two classes, however, often blend together, for some of the songs of birds are plaintive and melancholy, and some of the sounds of winds and waters are cheerful.

By companionship with nature all the pleasing sights and sounds become anodynes for grief and sorrow. The simple song of birds exercises a soothing effect upon the sensitive mind. Although the song of birds is without words, yet does it suggest a long train of thought. It brings before us images of forest glades, of orchard and field of scented clover and wild flowers, of brook and lake, hillside and dale.

Every scene and locality in nature has voices peculiar and indicative of its character. The sounds we hear on the ocean shore are unlike those heard in the interior; the echoes heard in the hollow ravines among the mountains are never heard upon the open plains. A gurgling stream rippling over its pebbly bed suggests music of fragrant summer woods, of cool retreats and sylvan scenes.

Nearly all the sounds made by water are agreeable; the roar of the surf, the fall of the cascade, are both soothing and tranquillising in their effects.

Each season has its peculiar melody. The soft, tender and pliable fo of Spring lends a mellowness to the sigh of the breeze not before not Nature then seems to be softened, subdued, as if to avoid all harsh interru to the general new birth and tender age of all growing things, not to inte the swelling anthem that issues from forest and garden by any harsh dis The echoes are less distinct; all nature seems now to reverberate to the of millions of musical calls, all toned in unison to a soft, rich melody. Sui seems possessed of a rich deep melody, subdued and voluptuous, in ke with her ripe, finished character. In Autumn the frosts give a clearer ri note to the voices of nature. The air is then crisp and cool, and the at phere rings as a metallic bell to the peals of the vast assembly of musical ir ments. The winds now become shriller, as they pass over the naked trees there is a sadness in their voice as they rustle the dry leaves and whirl th heaps in the fence-corners or rub the bare branches against each other. V Winter arrives, and envelopes the landscape in a canopy of snow, the e venture forth and hold supreme command. All the various voices of the and plain are heard with great distinctness; the distant croak of the rave scream of the blue jay, reverberate over the landscape through the frost When the sun comes out and the snow and ice melt, our ears are greeted change in the sounds of nature; the sharp creak of the frozen snow is hu and we hear instead the pleasant sounds from the dropping eaves and fi icicles, the gurgling of many small rills and the splash of water—suggesti the return of spring—the song of birds and the bloom of flowers. Ever different times of the day have their peculiar voices; thus the morning h vocal with the grand anthem of aroused animate nature. Then do the st of the glorious harp of nature vibrate to the notes of myriads of tiny in ments all tuned to one great universal song of praise at the dawn of a new During the night nature seems hushed in repose; the stillness of all t is remarkable, rendering every sound startling. Again at noonday, whe heat of the sun is oppressive, there comes a pause in the throb of nature's the very breeze appears to die away; but at even-time the rustle of the l attest the arrival of the zephyrs and the animate world again lifts its voi thanksgiving for another day's life to the great Creator.

The element of mystery lends a great effect to sound, and enhance sublimity of all nature. This is what lends such vivid effect to all voice sounds of the night; the cry of some distant denizen of the forest is much startling when enveloped in the pall of darkness; the sound of a footfal crack of a limb, are all startling when heard in the dead of night, accomp by the dread uncertainty that then enshrouds all objects. A traveler encamped alone in the midst of the deep forest or on the lonely desert, lies at night by his solitary camp-fire, is startled by every noise that b upon the midnight air; any unknown sound impresses the mind with a c sense of awe, especially if breaking suddenly upon the stillness of night.

GRASSES.

Perhaps some one, when he reads the title of this chapter, may turn away in disgust with the feeling that nothing interesting can be found in an article upon so humble an object as the grass of the fields, which, at first thought, has no use but to serve for food for the cattle, or to adorn our gardens, or, perchance, to vex the spirit of some poor school-boy who is told to weed out the intruder from the flower-beds or vegetable-garden.

But let us not under-value the least of nature's works, for nothing is created in vain. The most humble of God's works possesses attractions to the investigator who stops to examine and seeks out their nature and qualities. We are everywhere surrounded by objects of deep interest, which attract but little attention because their appearance is so familiar. But the contemplation of these objects gives rise to the most elevating and gentle influences, besides giving us a fund of useful knowledge.

Of what are commonly called grass there are many varieties. Some possess very useful qualities, while others seem created for the express purpose of beautifying the earth, and we might suppose that the soft verdure and the cool, refreshing appearance of a luxuriant grassy lawn, or field spread like a velvet carpet, covering with green the otherwise dull, brown earth, would excite a desire to investigate the nature and properties of this, the most useful because the most generally diffused, beautifier of nature; as an acquaintance with its structure and properties cannot fail to afford both instruction and entertainment.

The vegetable kingdom is divided into three great divisions: *Acrogenous*, *Exogenous* and *Endogenous*, referring to the different modes of growing. To the last of these belong the grasses. The word *endogenous* means inwards: that is, in plants of this class increase in growth takes place upon the interior of the stem, which is often hollow, though generally filled with a soft, pithy substance, which becomes harder as it nears the outer surface of the stem. In the leaves we have a peculiar and most characteristic formation: they are narrow and undivided; the veins all run parallel to each other, not branching off and forming beautiful net-work, so prominent in other plants; they are placed alternately upon the stems, with a sheath split down to the nodes, and a membraneous ligula, or stipule, at the juncture of the blade and the sheath. The stems are cylindrical and tubular, jointed and quite simple; the leaves are long, slender and narrow, the flowers are variously arranged, sometimes scattered loosely upon the stems, as in the oats, sometimes in a short, compact head, suspended from the ends of long, slender branches, and often densely crowded at the end of the stems in a lengthened spike. Each flower is composed of concave valves, placed one above the other; they are in little spikelets composed of bracts imbricated in two rows; glumes generally two, and unequal, sometimes only one. Paleæ, or inner bracts, two, alternate; the lower or exterior one simple, the upper or interior one often doubly carinate, being composed of two pieces

united at their edges. The scales, or inner bracts, are one to three; the st are one to six, commonly three. Anthers versatile; ovaries simple, wit styles and two feathery stigmas. Seeds a membraneous pericarp, filled a farinaceous albumen, at the base and on one side of which lies the en

Such, then, is a concise description, in the language of botanists, o humble friends, the grasses. I hope my readers will excuse its introductio before we study them we must begin with a little dry work, so as to be pre to investigate more easily, and have the benefit of what has been found c others before us. Every science has its terms which serve to carry a goo of information in a few concise words, and so save pages of description when once mastered will aid one immensely.

But to return to our grass. The flowers of the grass placed one abo other are most conspicuous when the beautiful white, yellow or scarlet an which are hung gracefully upon the slender filaments, project from the l the cup or corolla. The plant is now in bloom, and what can be more than a stem of slender waving grass tipped with its delicate bunch of fl and spangled with dew, glistening like tiny jewels in the morning sun. grasses which have leaves growing one above the other have jointed s which serve to strengthen the stem and support the leaf; but in such a the leaves growing from the root the stems are simple and not jointed, b strengthened by having the leaves triangular or square. Grasses and all designed for food either bear seed in great abundance or are supplie some separate and peculiar provision for reproducing themselves. In species whose seeds supply the wants of birds, the roots are perennia creeping, and are continually sending up suckers, thus increasing them many fold by a distinct method. In a very short time the grasses sen tall hollow stem, divided by joints where the leaves are inserted one l each joint on the alternate sides of the stem, each leaf embracing the ste a sheath. Such rapid growth is given the grass of the fields, which is of great use to man and beast, by a bounteous Providence. It clothes the and hillside with a carpet of velvet green; it renders the most repulsiv attractive by its soft, cool, and luxurient covering. Let us not despise it

The grasses love a cool climate, or one in which the Springs are coo moist, and the soft green turf of such regions contrasts strikingly wit coarse, scattered and tufted grass of hot, dry climates. In the tropics often attains the height of fifty to sixty feet. The leaves of such grass broad and resemble more the leaves of other plants. Grasses have an universal geographical distribution; some species flourish at alpine h others under the tropical sun. There are 234 genera of grasses and 3,000 species, of which 300 are found in America. Some species are l ornamental and others so curious as to be admitted into the garden amo flowering plants. No grass seems to be better adapted for fodder than tim which grows abundantly in the United States.

GEOGRAPHICAL DISCOVERIES.

The year just passed, 1875, has been distinguished by great activity in all branches of scientific research, but particularly in geographical exploration and discovery. The geographical explorations and labors in the United States have not been behind the rest of the world; they consisted, however, chiefly of the continuation of those heretofore begun by the Government, which embrace the labors of the coast survey, the government exploration parties in the west, and those of the United States' corps of engineers. W. H. Dall, who, in connection with the coast survey, has been engaged upon the north-west coast, has, after very careful surveys, ascertained the height of Mt. St. Elias, the highest mountain in the Union, to be 19,500 feet; Mt. Fairweather 15,500 feet, and Mt. Crillon to be 15,900. He also ascertained, approximately, the heights of Mts. Cook, Vancouver and La Perouse. He, also, is of the opinion that these summits are not, as has hitherto been supposed, of volcanic origin.

The Wheeler explorations and surveys west of the 100 meridian have been diligently and successfully carried out in Colorado and New Mexico. They found the districts explored extremely fertile, well-timbered, and the soil suitable for vegetable growth. Such parts as are not sufficiently watered may be made very productive by a system of tanks and irrigation. The climate was healthy. Prof. Cope, the Paleontologist, found abundant relics and traces of former civilization upon the Eocene plateau of New Mexico. On the summit of a hill, surrounded by a strong wall, was found the ruins of a town, called Cristone. The wall was, at first, supposed to be inaccessible, but a staircase of stone was discovered on the eastern face. In the Moquis villages the towns were placed upon the summit of hills and elevations, and surrounded by walls for defence, but they were always near some accessible water-course or spring, so that the inhabitants could carry on a system of agriculture; but these later discoveries failed to reveal any such provision. No cisterns were discovered, or any indications that the dwellers in these high places had water. Pottery was found scattered all over the land upon the hills and elevations. The country seemed to have been formerly very thickly settled, houses and villages being scattered profusely over the land. But the most singular fact was that the majority of the towns were situated at a great distance from any water-course. The existing Indians who visit this now uninhabited region know nothing of its former inhabitants, or how these ruins came there. It seems strange that a people, who, from the ruins they have left behind them, must have been very numerous, and somewhat advanced in civilization and the arts, should have so utterly passed from the surface of the earth as to leave no trace, except these dismantled cities and villages, to tell of their existence. Dr. Loew explored ruins of the same character in New Mexico. In Astlan he found structures of stone containing upward of 500 rooms. Over the solitary and desolate plains were found, profusely scattered, solitary buildings, all from fifteen to twenty miles from water. Yet, in this case, each building had its water-tank to catch the rain.

Upon the narrow ridge of a precipice, between colossal walls of sand close to a frightful abyss or chasm, were found the ruins of a town cont eighty houses, some in regular, parallel rows, others in squares, and some pe in gaps among the overhanging rocks. The houses were nearly all of one and two rooms; the roofs had fallen in, and, in some cases, the side Pottery, charred corn and instruments for grinding grain were found sca about in profusion. The position of this town appeared impregnable, bu Indians said that the Spaniards took it, and that the inhabitants, in their and despair, threw themselves headlong into the frightful abyss below. M tale of the deepest interest and tragic end has been enacted, unrecorde forgotten, until the final time, when the "sea shall give up its dead, ar world shall be judged for the deeds done in the flesh."

The Black Hills are described by Prof. Jenny as rising like islands fr ocean of grass and tree-covered plains. The climate is healthy, one-twe of the soil fit for grain and cultivation, and the hillsides fit for grazing. gold fields are not rich enough to pay for primitive mining.

Prof. Hayden's party spent from June to November in explorir Colorado mountains, and surveyed 25,000 square miles in the south-west of the territory. The Main party explored the south-eastern part of covering 6,000 square miles. It is of volcanic origin, and presents many cor and grand volcanic phenomena.

In Florida shell heaps and pre-historic remains have been found upo St. John's River of great interest. They indicate that a people formerl habited that portion of our country, who were neither hunters nor agricultu but subsisted upon shell fish, as the heaps indicate. They belonged t carib race. Pottery, stone, shell and bone implements were found; also ar fire-places. Large trees were found growing upon the mounds, showing great antiquity. Some few human bones were found—not in graves, but in broken, disturbed heaps, indicating a cannibal feast. Prof. J. Wyma given a very interesting memoir upon these ancient relics.

In Arctic exploration this age has not been inactive or behind f periods. The most important event of the year has been the dispatch l British government of an expedition for the discovery of the North Pole, the command of Capt. Nares When last heard from it was in Smith's S Quite a number of other expeditions have been sent out by the Russian gc ment and by private individuals. An expedition under Prof. Nordenski Swede, was despatched last summer at the expense of a single individu Dickson, of Gottenburg. Its object was to pass around Nova Zembla an North Yenissei, which would, they supposed, be rich in the bones of the moth and in pre-historic remains. They penetrated as far as 75° 30 sec. latitude, when they sailed for the Yenissei. They ascertained that ther fine harbor on Northeast island and that the mouths of the Obi and Ye were free of ice, and though shallow, sufficient for the establishment of between Europe and Siberia, which will enable Siberia to ship her prc

along her great rivers. The explorers were still north of the Polar Circle, a region supposed to be covered with snow and ice, instead of which they found vegetation luxuriant and beautiful.

In Asia, the British Palestine exploration expedition has surveyed an area of 4,430 square miles. The Russians have decided to construct a railroad across Asia, the route to be from Nizhnec-Novgrod to Kasam, Ekaterinburg to Irumen, ultimately to reach Pekin by the desert of Gobi.

In India, many explorations have been pushed. A Mr. Bond captured two of the strange dwarfish race of men who live in the hill country of Western Galits, to the southwest of the Palini Hills, of whom no trace had hitherto been found. A man and a woman were found; the former was four feet six inches high and 26¼ inches about the chest. His skin was dark brown; his head round, with coarse, black, woolly hair. The lower part of the face projected like a monkey's, with thick lips protruding an inch beyond the nose. He had a comparatively long body and short, bandy legs. He had also a grayish bristly moustache, but no beard. The woman was well developed and about the same size. She was of a yellow tint, with long, straight glossy black hair, and a pleasant expression. They were dressed in loose clothes, and, though they eat flesh, they lived principally on honey and nuts.

In Africa, geographical explorations have been pushed vigorously. The Victoria Nyanza has been explored by Stanley, and the territory across the continent by Lieut. Cameron from Lake Tangenyika to Benquella on the western coast in latitude 11° 56 sec. south. An Egyptian geographical society has been organized for work in Northern Africa. It already numbers 300 members, with an annual income of $7,000, with the Khedive at its head.

Great attention has been given of late to the subject of the tides, meteorological investigations and weather reports. Signal stations are being organized all over the United States, England and other countries. The subject of ocean currents, deep sea soundings, and rain-fall, has been the subject of much investigation and research. The voyage of the "Challenger" has been the fruit of much knowledge of the bottom of the oceans.

Such is a very hasty, brief and imperfect resume of the geographical explorations of the year 1875. It has been rich in fruits of all branches of science, of which many excellent elaborate reports are being prepared. We shall give our readers the results from time to time of these reports and keep them advised of the progress of the world's advancement in knowledge and science.

Caterpillars never produce young; flies, bees, etc., never grow larger after their escape from the cocoon. Most people suppose that the little flies that we see around are the same kind as the large ones, only younger; but the fact is, flies never grow large after they are hatched out from the cocoon.

INFUSORIA.

This class of animals, the most minute of created beings, is one revelations of the microscope, which is calculated to fill the mind with found astonishment at the great abundance and wonderful variety of life. Although so minute as to elude the unaided vision, they possess variety of form and size. They are very active, and seem to be conti in motion, darting about with the rapidity of lightning. Nearly every dr water on the surface of the earth appears to contain them in greater or les fusion. Some of them are not more than one two-thousandth of an in length, and the generality of the race does not exceed one-fiftieth of an in length. Eight hundred thousand millions have been found in a cubi of water, and a thousand millions in a single drop of water. Until th covery of the microscope little was known in regard to this multitude of tisimal beings, which, though so minute, yet live, move and have their pe habits, worthy of our investigation and study, a strange world of their o which much yet remains to be discovered. The investigation of these n beings is wonderfully fascinating, and richly repays for the labor.

The earlier investigators grouped together, under the term of animal a vast variety of living organizations, having nothing in common, except minuteness of size. Plants, mollusks, animals, insects, crustaceaus and w larvæ and perfect forms, were all aggregated together in the one vague t animalculæ.

The labors of modern scientists have resulted in separating and distril this motley mass of animal and vegetable life among the various classes, lies and orders to which its heterogeneous materials properly belong, an formation of a class to which the name Infusoria, by Muller, is now universally applied, for this the lowest and most minute form of anima thus excluding from this class all vegetables, insects, or mollusks. The Inf abound in every ditch, pool, lake or river, and are equally common in s fresh water; they have been found in hot springs, of high temperature, a the melted snows of arctic regions, in fact wherever water and decaying table matter exist there will be found the Infusoria. They are sometimes c up into the atmosphere and wafted from place to place by the winds wit watery vapors. Many forms of the Infusoria are not destroyed by con desiccation, and therefore are mingled with the dust, and in this conditio carried by the winds, to resume their vitality as soon as they chance to fal water.

If we consider their vast and incredible numbers, their universal dist tion, and their insatiable voracity, and that their food consists of the par of decayed vegetable and animal matter, we can at once see the great l these minute creatures perform in purifying the atmosphere and waters. these ever-active, invisible scavengers are we indebted, in no small degr the salubrity of the air we breathe. They also serve, by devouring the orga

matter suspended or dissolved in water, to preserve it from final decomposition into the elementary gases, and its gradual diminution in amount. Having thus arrested its further decay, by assimulating it into their own bodies, and thus turned it back into the stream of animal life, they themselves, in turn, become the food for larger beings, and so the tide of life flows on from one created being to another in a never-ending circle. The dead and decomposing matter thus being converted by this process of assimulation and destruction of one animal upon another, food for the highest created beings is formed.

The animalculæ have a very simple organisation, having neither nerves or vessels, and are made up of a uniform tissue. Although some of the higher groups have the outer layer of a denser composition, while again this outer layer, in some, is converted into a distinct skin, and lastly, in the more complex and higher groups, it is transformed into a shell or case. They have no feet or external limbs. A few of the lowest types have the power of protruding portions of their homogeneous structure in the form of limbs, which they use both for grasping their food and locomotion. In the higher forms progression is by cilia, or very minute hairs. This motion is probably automatic, as it is constant, day and night, the little creatures never sleeping or taking rest; yet they seem to avoid obstacles in their rapid course.

The whole subject of the life and habits of Infusoria is yet involved in mystery, and presents a wide and attractive field for study. The two great obstacles which present themselves in any attempt to form a natural classification of the Infusoria are the difficulty in distinguishing the lower forms of animal life from the corresponding forms of vegetables, and that of deciding whether a given form is permanent, or is merely the larvæ of an insect, or some one of the various forms that crustaceans, polypes and other of the lower animals assume in the progress of their alternations of generation.

The best method to distinguish animal from vegetable formations is the food or nourishment taken by both; vegetables consuming inorganic, and animals organic food. But there are exceptions to this, though not many. Another distinction is that plants give out oxygen and absorb carbon, while animals absorb oxygen and give out carbon; this, however, is subject to some exceptions. A third test is motion; but here are the most exceptions, for the spores of simple aquatic plants have a motion not to be distinguished from the spontaneous motion of animals. By most naturalists the first test is believed to be the most reliable, and least subject to exceptions.

As to the second source of difficulty, the power to distinguish the Infusoria from the larval forms and the varying shapes assumed by Polypes, etc., the difficulty is very great, and Agassiz has suggested that all Infusoria are merely the germs of aquatic worms. If this should prove to be the case the whole class would have to be broken up, and the individuals of which it is composed distributed about among the different classes of the lower animals. The following classification has been adopted by Ehrenberg, which, although possessing many merits, is yet subject to great disadvantages. He divides the Infusoria

into two great divisions—Polygastric, or many stomached; the Infusoria c division possessing certain internal cavities, resembling enlargements o alimentary canal, although, probably, none possess any stomachs, and ma alimentary canal at all. His second division is the Rotifera, or wheel an distinguished by a peculiar arrangement of the cilia upon lobes near the m which, when in a state of active vibration, gives to the lobes the appearan wheels in rapid motion. Although by many naturalists this division has separated from the Infusoria on account of their higher and more co organization.

The following diagram will show the classification of Ehrenberg:

POLYGASTRIC INFUSORIA.

	Having Shells.	No Shells.
Anentera, having no digestive tubes:		
1. Protruding part of their bodies, like feet, . . .	Arcellina.	Amœbæa
2. Having Cilia, ...	Dinobryina.	Astasiæa
3. No Cilia, ...	Peridinæa.	Cyclidin
Enterodela, possessing a digestive tube:		
1. One orifice to the digestive tube, . .	Vorticellina.	Ophrydi
2. Two orifices to the digestive tube, one at each opposite end of the body, .	Enchillia.	Colepina
3. Two orifices, placed irregularly, — Trechelina, having a proboscis, but no tail,		Aspidisci
3. Two orifices, placed irregularly, — Ophryocercina, having a tail and an anterior mouth,		Kolpodia ing by
4. Having two ventral orifices, . .	Euplota.	Oxytrich moving other or

The Amæbæa are a jelly-like mass, without determinate shape, in te nearly uniform, having no integument, being slightly more fluid at the c and having at some point near the surface a vesicle, which pulsates pretty larly. When the little creature is about to move, a current of the more c fluid is seen tending toward some one point of the circumference. Soon a tion of the mass protrudes; it elongates, until it becomes perhaps doubl length of the body of the animal. The mass of the body then seems to ad into the protruded and elongated portion, and in this way locomotion is effe The manner of feeding of the lower classes of animalculæ is singular. one of its rays comes in contact with some suitable food it is seen to adh it; the ray slowly shortens and draws the prey to the surface of the body surrounding filaments attach themselves to it, bending their points togethe

closing over it, until it is enclosed on all sides. Gradually a cup-like depression is formed in the surface of the body at the base of the ray to which the food is attached, and into this the prey is crowded, till the cavity still growing deeper, the whole mass becomes embedded in the very substance of the body of the animal, which gradually closes around and over it, and thus the mass comes to be contained in a cavity or stomach formed on the moment for its reception. Here it is digested and its nutritive portions absorbed; and now, when this is accomplished, the undigested portions, if any remain, are protruded towards the surface and finally expelled from the body. The opening through which it was expelled closes behind it and the animal resumes its former shape and condition. They multiply by self-division.

Ascending in the scale, we reach the Enterodela. All of these animals have a mouth through which food is taken, and many an anal orifice through which excrement is excluded. They all have an external integument and the internal cavity or substance of the body is divided into separate chambers by divisions. Through these the food passes and is digested, the indigestible portions being ejected through an anal opening or by the mouth.

In most Polygastric Infusoria, from one to twelve small vessels appear, containing a clear, colorless fluid, which expands and contracts regularly. These are probably receptacles for nutrient fluids. In the mass of the substance of the body of all Infusoria appears a solid granular-looking mass of exceedingly variable form—round, curved, long, or in some cases branched. This is called the nucleus. This seems to have some connection with reproduction, for here when spontaneous self-division occurs it invariably commences. Although this division begins at the nucleus, the manner of division is very different in the several species, sometimes transversely at others longitudinally. These spontaneous divisions are completed in a remarkably short space of time. As many as 268,000,000 may be produced in a month.

Another mode of reproduction is by conjugation: two individuals attach themselves together, until, at length, their entire bodies coalesce and form one animal, in the interior of which a new individual is formed, and, in process of time, is discharged from the parent body, either by splitting or through some orifice.

Still another form of reproduction has been observed in some Infusioria: an individual secretes upon the surface of its body a thick, glutinous substance, which speedily hardens until it becomes a firm case or shell, in which the animal is shut up, but not so closely as to prevent free motion. The animal itself now soon undergoes a change: the cilia are retracted; the animal assumes a regular circular outline, then either the whole body, or the nucelous alone, breaks up into many separate and distinct fragments, each of which assumes an independent life, and move freely about within the body of the present organism. This mother cell now bursts, and is disintegrated; while the young brood, set free, swim forth, either in the form of the parent or in some transition shape, from

which, through one or more changes, they gradually assume the form of parent.

The Rotifera, or wheel animals, have little in common with the c Infusoria, either in shape, form or habits, being both more highly organized formed upon a different plan. Their name is derived from the peculiar arr ment of the cilia, covering the two lobes at the anterior extremity of the b which, when in motion, resemble two minute wheels in rapid rotation. Rotifera are minute, worm-like animals, very transparent, without legs, a dis alimentary canal, a mouth, eyes, and are reproduced by ova only. The g has two jaws, each having from one to five teeth; the body has two integum the outer very thick, firm and horn-like, from which the head and tail pro near the tail is a claw, by which the animals attach themselves, but can let g an instant and swim off. The stomach and intestines are well developed; se distinct longitudinal bands of a highly contractile tissue pass the entire le of the animal, and also many transverse bands of the same character. The no proper circulatory apparatus, yet water is freely admitted into the body kept in motion by cilia lining the tubes into which it is introduced.

Reproduction in the wheel animals is produced by eggs, and never by division, as in the Polygastric Infusoria. From the transparency of the ti of the Rotifera, it is possible to trace the growth and development of the with great ease; in some cases the egg is hatched in the ovary, and the y are seen within the body of the parent, where all its details of structure ma studied in full.

It would be impossible, in the limits of so short a space as is at our comm to give more than the above brief and necessarily inadequate account of large class of beings: their number is so great, the variety of form and sha varied, that volumes might be filled, and yet the subject would be inexhau Nevertheless, perhaps no class of animals are so little known—their minute the great difficulty of their study, and the immense number of their sp render the task one of no small difficulty. Yet no branch of natural sci offers greater inducements to the naturalist. Their strange habits, great be and variety of form and shape, and inexhaustible numbers and myria species, make a field of inexhaustible study of enchanting variety and int so different from the world about us, that they seem to form a miniature c tion—an infinitisimal world of their own, with habits and actions widely diff from those we are accustomed to see. Then, we have an entire creation, were, in one small drop of water: a little world of myriads of living, m creatures, darting about, devouring one another, all before our eyes. The w existence of a creature being enacted before us: its birth, mode of procuring its pursuit and escape from its enemys, its attacks upon its foes, its plays an maturing; and, finally, its end, tragic or not, as the case may be—all enact the sphere of a microscope in our parlor. What a study! what a theme fo entertainment! Nature is indeed lavish in her plans for the instruction

improvement of man, and no excuse can be given that there are no materials to be had for investigation, when there are whole life histories enacted in a drop of water—whole classes of beings, of many diverse species, presented to our view beneath the glass of the parlor microscope.

The heat-conducting power of different substances is exceedingly various. Thus, metals are generally very good conductors, while animal substances are very poor. Feathers, wool and hair are imperfect conductors, and thus retain the heat of the substances they surround; while gold is a very good conductor. therefore a metallic substance, although of the same temperature and in the same room with a woolen garment, will feel cold to the touch, because it *draws* off the heat from the hand; while the woolen cloth will feel warm, because it is a poor conductor and serves to retain the warmth of the body.

All metals do not have equal powers of conducting heat. This may be shown by inserting the end of an iron and silver wire, of equal size, into the flame of a lamp. While the end of the silver wire between the fingers will soon become too hot to hold, the end of the iron wire remains comparatively cold for some time. Glass is a much more imperfect conductor than any of the metals. Solids, when pulverized, lose much of their conducting power. Thus, one may hold live coals in the hand if a thin layer of sand is placed thereon.

Liquids are rather poor conductors, but have the power to convey heat with facility. But heat cannot be conveyed downwards through a liquid. Hence a vessel may be filled half way up from the bottom with cold, and the upper portion with boiling water, and they will not commingle. The upper portion of a glass filled with water may be heated to the boiling point by a flame applied to its upper surface, and remain perfectly cold in the lower portion.

The earth, in calm, clear nights, sends out rays of heat into space, by which means the temperature is much reduced. The air which rests upon the immediate surface of the earth becomes colder than the upper layers, and its moisture is condensed and deposited upon the earth in the form of dew, or hoar frost. When the sky is overcast with clouds there is no deposit of dew, because the clouds act as a blanket to protect the earth, and throw back to the earth the heat rays radiated to them. When the air is agitated by winds there is no dew, because the moisture is carried off and not left to be deposited upon the ground.

MUSICAL SANDS.—In many portions of the world are found sand beaches that emit musical sounds. One is to be seen on the Sandwich Islands, and one at Famine Bay, Lake Ontario. A microscopical examination shows that the grains of sand contain cavities, which are the cause of the sound, and that when damp the cavities are filled, and the resonance ceases. The sound made upon the beaches is occasioned by the waves moving the grains of sand over one another.

The fact that the sources of the Congo and Zambese Rivers are so ne one another that their waters mingle in the rainy season, is made the occ of a project to connect the Indian Ocean to the Atlantic by a canal, anc open a new channel of navigation across the heart of Africa. This c accomplished, Lieut. Cameron says, by a canal only twenty miles long, th a level plain, costing not much over one million pounds sterling. Althou canal may be feasible, the cataracts in the Congo and Zambese would still obstacle to be overcome before vessels could pass through from ocean to oc a task of no easy accomplishment.

A discovery of remarkable interest was made by Lieut. Cameron, researches in central Africa. We refer to the lake villages found in Lake M such as existed in Switzerland prior to historical times. Hitherto our know of the ancient lake-dwellers has been, to a great degree, conjectural. been supposed that ages have passed away since these singular peopl departed from the earth, and sunk out of sight and memory. But now, i heart of Africa, is suddenly found a people whose habits, mode of li characteristics are no doubt identical with the long-lost Swiss-Lake dwelle is as if a page of long-lost history was discovered, and is of inestimable val the historian and archiologist.

A WONDERFUL DISCOVERY.—The discovery of the great boiling lake island of Dominica has excited much scientific interest. This lake is u steep, forest-covered mountain behind the town of Rosseau. It is 2,5o above the sea, and is two miles in circumference. On a recent visit by a of explorers, when the wind blew aside the dense clouds of steam and sulph vapours which covered the lake, a mound of water was seen fully ten feet l than the general surface of the water, caused by ebullition. The margin lake consists of beds of sulphur, and its overflow found exit by a very waterfall.

WORK FOR MICROSCOPES.—The work which may be done by the micro is of three kinds: 1st. The study of objects which have been already thoro investigated, but which we wish to see for ourselves instead of having to d upon mere description or engravings. 2d. Researches, having for their the discovery of new—that is to say, hitherto unknown—truth. 3d. The tion of practical problems, such as adulterations, medico-legal question examination of fibres, etc. In the first and second classes of work, eve cheaper forms of the microscope may be made to perform good service. the third class is one which, from its importance and from the immediat serious nature of the personal relations involved, should never be attempt any but experts, and not even then unless by means of the very best instru that can be procured.

A PETRIFIED FOREST IN NEVADA.—On the great plain, about thirty miles west of the Black Rock range of mountains, stands one of the greatest natural curiosities of the west. It is a petrified forest, in which the stumps of the trees, now changed into solid rock, are still standing. There are no living trees or vegetation of any kind, other than stunted sage-bush, in the vicinity. Some of these ancient giants of the forest, which perished thousands of years ago, when the climate of Nevada was more favorable to the growth of luxuriant vegetation than at present, rival the largest trees of California in size. Stumps, transferred into solid rock, stand upright with their roots embedded in the soil as when growing, measuring twenty to twenty-six feet in circumference. The ground is strewn with trunks, limbs and branches, all turned into stone. A section of one stump, eighteen feet in circumference and three feet high, has been cut off from one of the standing stumps, and is to be sent to the Centennial Exposition.

The swallow, swift and nighthawk are the guardians of the atmosphere. They check the increase of insects that otherwise would overload it. Woodpeckers, creepers and chickadees are the guardians of the trunks of trees. Warblers and flycatchers protect the foliage. Blackbirds, thrushes, crows and larks protect the surface of the soil. Snipe and woodcock the soil under the surface. Each tribe has its respective duties to perform in the economy of nature; and it is an undoubted fact that, if the birds were all swept off from the earth, man could not live upon it, vegetation would wither and die, insects would become so numerous that no living thing could withstand their attacks. The wholesale destruction occasioned by the grasshoppers, which have lately devastated the west, is undoubtedly caused by the thinning out of the birds, such as grouse, prairie-hens, etc., which feed upon them. The great and inestimable service done to the farmer, gardener and florist by the birds is only becoming known by sad experience. Spare the birds and save your fruit: the little corn and fruit taken by them is more than compensated by the vast quantities of noxious insects destroyed. The long-persecuted crow has been found, by *actual experiment*, to do *far* more *good* by the vast quantity of grubs and insects he devours than the little harm he does in a few grains of corn he pulls up. He is one of the farmer's best friends.

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VOL I. NO. 7.

1876

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A MAGAZINE DEVOTED TO

The Natural Sciences.

E. H. FITCH, Editor and Proprietor.

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TOLEDO, OHIO:

BLADE PRINTING & PAPER COMPANY

The Scientific Monthly.

VOL. I. No. 7.

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Any papers sent to the editor will be carefully preserved, and returned to the contributor if desired.

The Secretaries of Scientific Societies are respectfully solicited to forward to the Editor, as soon after the meetings of their respective Associations as convenient, all reports of the proceedings and synopsis of essays and addresses read before them.

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FIELD SPARROW.—Natural Size.—Drawn from Nature by E. H. Fitch.

The Scientific Monthly

DEVOTED TO THE NATURAL SCIENCES.

VOL. I. APRIL, 1876. N

THE VESPER BIRD OR FIELD SPARROW.

(*Spizella Pusilla.*)

Soon after the wintry blasts have left us, and before the flowers ar spangling the meadows with the varied colors of the kaleidoscope, w greeted by the sweet, clear and fervent notes of the Field Sparrow, or a justly called by one of our most eloquent writers on nature, the vesper poured forth with a peculiar, melancholy and pensive modulation. The resemble the trill of the canary, but are more subdued and plaintive and h reedy sound.

This little singer is somewhat periodical in his singing habits, confinin songs to certain hours of the day and conditions of the weather. He join great body of songsters in the general anthem of praise at sunrise, which he sings at intervals during the day, especially when still and cl but most energetically at evening, from sunset to dusk. Hence its from its evening hymn or vespers. There are also particular state conditions of the weather that call forth its musical powers, as when rain is denly followed by sunshine, or when the sun is suddenly overshadowed cloud, thus occasioning a sudden and temporary morning and evening. also is in the habit of trilling his clear but plaintive notes at all hours c night, particularly at midnight, and even when there is no moonlight ar landscape is shrouded in darkness and gloom. In this respect I thinl species is peculiar, and what can incite its lay at such unwonted times is y unsolved mystery.

The usual resorts of the Vesper Sparrow are hay fields, orchards anc tures. His voice is frequently heard by rustic roadsides, as we take our

ing walks, trilling out clear, plaintive notes when there is scarce light enough to see the fences by the way; indeed, nightfall seems its favorite time for singing, and the effect of its sweet voice as it rings out clear and distinct upon the midnight air, when all nature is hushed in repose, is indescribably sweet and plaintive. Withal, it has something of the mysterious in its composition, seeming out of place, as if it was some spirit's call from another world.

But, coming as it does at the still, dark and mysterious hour of midnight, when all the rest of nature is buried in silent repose and gloomy darkness, it rings out like some sweet message of consolation and soothing sympathy to the rest of the world. At these times at night its note is seldom repeated, but it trills forth its sweet, plaintive song once and then sinks into silence, as if it had raised its head from repose to warble its plaintive note as a message to creation that all is well, and then sank back in its nest to slumber again.

The song of birds is very intimately connected with poetry and sentiment. It serves to sooth and console the human mind and arouses images of fragrant forest glades, gurgling brooks, flowery dells and green pastures. The music of birds is modulated in pleasant unison with all that is lively, beautiful and sweet. It dispels all wicked and angry passions and brings thoughts of love and goodness to the human breast. Birds are truly one of God's best gifts to mankind, for aside from the pleasure they afford us by their sweet music, graceful motions, varied and brilliant colors, and lively and engaging manners and habits, they do inestimable and indispensable service to the human race in the destruction of myriads of noxious and destructive insects that otherwise would utterly destroy the fruits of his labors. In fact, it is beyond question that man could not exist upon the world if the birds were destroyed, for it is only by their continual efforts that the insects, so injurious and destructive to vegetation, are kept in check, which if left to multiply would soon completely destroy all vegetable life upon the earth, and it is utterly beyond human power to effect any check upon their growth.

The Field Sparrow is resident in the United States, and in its migrations does not stray far from its summer abode. It is found from Canada to Virginia and from the Atlantic to the Red River in summer. In winter it is found in Texas and all the Southern States. It is a retired and rather shy bird, avoiding the presence of man. It arrives in Massachusetts early in April and departs the latter part of September or first of October. It has two broods in a season. The nest is placed on the ground in low bushes or among the tangled clusters of vines. Probably the nature of the surface has something to do with the position of the nest, for in high, dry pastures, in sheltered situations, they build their nests on the ground, while in wet meadows and fields, subject to overflow or dampness, the nest is placed in bushes at a height of two or three feet. In Louisiana they begin to nest in May and have three broods in a season; while in New England, where the season is short, they often have only one brood. The nest is composed of a few stems of vegetables, grasses and sedges and lined with hair and fine roots. Those placed

upon the ground are said to be larger and more bulky than those plac bush, while more care and neatness is displayed upon those in a bush eggs are five, oblong-oval in shape, white, with blotches of ferruginous In some, these markings are few and arranged about the large end; in they are numerous, generally diffused, and impart a deep, ferruginous c the whole egg, which disguises or conceals the ground. The size is .7o inch. The size of the nest is four inches in diameter and two inches and in height. The periphery and base of the nest is constructed of minut of dry grasses and vegetables. The ends of these project from the ext the nest around the upper rim, resembling a fence or enclosure of pa around the margin of the structure. The interior is warmly line horse hair.

The Field Sparrow's song is continued in full force until into the m July or the hatching of the second brood, when it somewhat relaxes, b not cease singing entirely until its departure in September.

The Field or Vesper Sparrow is six inches long. The bill is short, nearly as high as long, the lower mandible larger than the upper, the c sure gently sinuated; nostrils basal lateral open; cutting edges of bill s The end of the chin groove is beneath outer corner of the nostrils. Its is circular. Tarsus longer than middle toe; hind toe half as long as mid longer than outer toe, which slightly exceeds the inner toe. The claw o toe reaches the base of the claw on middle toe and is half as long as Tail slightly forked, or divaricated at the exterior end; secondaries and equal in length. The wing is short and rounded; it reaches to the mi the tail. First wing quill somewhat shorter than the second, and equal fifth. Third quill longest. Second, third, fourth and fifth quills sinu the outer webs. Tarsus equal to skull. Bill contained one and one-hal in the skull. Bill is one and one-third times as long as high. Tarsus o one-third times middle toe. There are five plates on front of tarsus; each side joining in a sharp edge behind, and to frontal plates anteriorly. and wing equal in length (carpal-joint end primary.) Bill red. Crown head a plain rufous red, with a very faint, indistinct indication of an ashy stripe, and an ashy nuchal collar. Sides of the head and neck, with th neck, and stripe over the eye, ashy. Ear coverts, rufous. Back and sca rufous with shaft streaks of black. Lesser wing coverts, plain brown. M and greater wing coverts, brown, tipped with white, forming two white across the wing. Wing quills brownish black, faintly edged with white. secondaries and tertials are edged up outer web with rufous. Rump and tail coverts grayish brown. Tail brown, each feather faintly edged with Entire lower parts plain white, tinged yellowish upon the throat, brea sides under the wings. Under wing coverts plain white. Legs and fe color; claws black; lores whitish. Tail composed of twelve feather second on each side the longest. Weight, one ounce avoirdupois.

MEASUREMENTS.

Tip of bill to forehead	$\frac{3}{8}$ inch.
" " end of tail	6 inches.
" " end of middle toe	$5\frac{1}{2}$ "
" " corner of mouth	$\frac{1}{2}$ inch.
" " hind head	$1\frac{1}{8}$ inches.
" " nostrils	5-16 inch.
" " chin feathers	4-16 "
Height of bill at base	4-16 "
Width of bill at base	3-16 "
Diameter of eye	$\frac{1}{8}$ "
" " nostrils	1-32 "
Carpal-joint end primaries	$2\frac{3}{8}$ "
" " " secondaries	2 2-8 "
Tail, longest feather	$2\frac{5}{8}$ inches long.
" beyond upper coverts	2 inches.
" " lower coverts	2 "
" " longest primary	1 6-8 inches.
" " end middle toe	$\frac{1}{2}$ inch.
" " secondaries and tertials	2 inches.
Tarsus	$\frac{5}{8}$ inch.
Middle toe	$\frac{1}{2}$ inch; its claw 2-8 in.
Outside toe	2-8 " " $\frac{1}{4}$ "
Inside toe	2-8 " " $\frac{1}{4}$ "
Hind toe	2-8 " " 5-16

Wing Formula :—First, 3-16th inch shorter than longest; second, longest; third and fourth, equal to the longest; fifth, $\frac{1}{8}$ inch shorter than longest; secondaries and tertials, 3-8th inch shorter than longest wing quill.

Extent of wings, $8\frac{1}{2}$ inches. The tail feathers are very long and narrow. The feathers are nearly of an equal length, the fork or divarication being very slight.

THE DIRECTION OF CIRRUS CLOUDS.—The movement of the cirrus clouds has been the subject of study by Hildebrandsson of Upsale, who hopes thereby to deduce some results relative to the ascending and descending movements of the atmosphere above the regions of high and low barometer. The observations of Clement Ley show that the cirrus clouds move from areas of minimum toward areas of maximum pressure, and Hildebrandsson has endeavored to extend this interesting generalization over a wider field. He states, in fact, that a general study of the clouds over the whole of Europe shows him that while the air on the earth's surface moves in spiral curves, inward, toward low barometer, the air at a high altitude simultaneously moves outward. The principal winds, therefore, constantly make an angle toward the right, with the lower winds. This determination was long ago made by Abbe for the United States, and may probably now be considered as a general rule, applicable throughout the world. It is important to notice that the same conclusion was arrived at deductively by Ferrel in 1857, and is fairly stated in his great work on the motions of bodies on the earth's surface.

WATER SCENERY.

Nothing in nature gives so great a charm to a prospect as water. A lar without water loses half its beauty. Water is emblematical of purity an quillity; it is suggestive of quiet and repose. The mirrored surface of stream, reflecting the forms and hues of the trees and flowers upon its ba the fleeting clouds of the heavens, or picturing in its calm bosom the my starry hosts above, as if a second heaven was spread before us, is pleas enchanting to the eye. The beauty of a sheet of water, its waves treml the moonlight, or sparkling in the sunshine—each wavelet appearing as if with silver or gold—transcends almost all other objects in nature. A g fountain, or sparkling rill, rippling over its pebbly bed, kissing the moss and reflecting the violets and daisies upon its margin, has charms attrac everybody.

In water we have color, motion, form and sound, all combined, their assuming an ever-changing aspect—each seeming to surpass the other loveliest tints of heaven are here displayed in profusion and perfection dews and spray of the ocean, the falling rain-drops—all disclose the l and most varied colors, and diverse forms. The sinuosities of the as it winds its way like a thread of silver, now hid by the environi now disclosed as it winds across the green plains, adds charms of gra color to the landscape.

Water thus not only possesses beauty in itself, but it is the chief so pleasing variety and charm in the landscape. Whether we view it as spr in the tranquil bosom of the lake, the silver thread of the winding river, c ing, with its glittering ribbon of white, with the green of the surrounding or the endless curving outlines of the sea shore, now presenting bold headlands, now smooth, rounded beaches.

A rippling stream is one of the most beautiful adjuncts of a landsca flowing tranquilly between moss-covered banks—its clear bosom reflect interlacing boughs above entwined by honeysuckles and grape-vine, its sprinkled with wild flowers of various colors, for water gives added li vigor to all the productions of nature, while the fragrance from tree and follows its rippling course to entice the bees and humming-birds to s sweet nectar from their cups. Then, passing from this wild but qui scene, where the tall trees—

> "All weave on high a verdant roof,
> That keeps the very sun aloof,
> Making a twilight soft and green
> Within the column-vaulted scene."—*A. Street.*

So full of sylvan beauties and fragrant odors, enlivened by the s birds and note of insect life, it flows past rocky banks, murmuring and g over its stony bed, toying with the ferns that line its borders, anon das crystal waters in snow-white foam over the precipice, with the roar c

waters, the sunbeam gilding its spray in tints of many colors, forming rainbows of brilliant bands, which span its course with beautiful arches. Then, leaving this rocky chasm, it flows onward past fields of green pastures or golden grain, sparkling and murmuring as it pursues its cheerful way, until it loses itself in the broad and illimitable ocean.

One of the sentiments often awakened by a water prospect is that of sublimity. But this can not arise except from an extensive view of the ocean, or other broad expanse of water, or from the sight of a great cataract. Ordinarily, therefore, except by the sea shore, we seldom behold a sufficient expanse of water to affect us with this sentiment. The ocean excites feelings of sublimity by its broad, illimitable expanse, and rises to the terrible when lashed to fury by the tempest, as it dashes in thunder tones against the rock-bound shore. The view of the illimitable ocean, from where no land can be seen, and the horizon is bounded by nothing but sky and water, gives rise to the sentiment of infinity and sublimity; but the eye soon tires of the monotony of water and sky. The views presented by the sinuosities of the shore, intersected by bays and inlets, presents more variety and change, both of color and form, and are consequently more lasting in their pleasurable effects upon the mind.

Water needs the accompaniment of land and vegetation to form a picture that is agreeable to the eye. Without such adjuncts it is like a sky without clouds. A few islands scattered over the bosom of a lake or river, especially if relieved by green foliage, much enhances the view. A calm lake without islands charms us chiefly by its own crystal waters mirroring the trees and flowers scattered upon its banks, but this beauty is much enhanced if a few green islands are set, like emerald gems, upon its bosom, the silver-white surface of the lake forming a fit and lovely setting for the green islets and winding shores, all reproduced in its clear bosom in duplicate, as if they hung suspended between heaven and earth. Small lakes and streams greatly enhance the beauty of pastoral scenes by their contrasts of form and color, and their suggestion of plenty and fertility. A picture of rural scenes is much enhanced if a quiet pond or stream is introduced, with cattle standing up to the knees in the water on its margin, giving rise to thoughts of a quiet and warm summer day.

The broad expanse of prairie, waving its green surface, spangled with many colored flowers, is, at first, a beautiful sight, but one soon tires of its monotony, and readily seeks in joy for the long and ever-welcome sight of the bright, glistening water, when its soft murmur is heard in the distance. Then that innate love of variety, so deeply set in the heart of all, springs forth to greet the joyful sight, which relieves by its ever-changing aspect and its pleasing ripple, and satisfies the human heart. Water, thus combining the elements of motion, sound and color, ever supplies an unchanging and beautiful variety to the landscape. The rugged, wild and rocky mountain scenery is much relieved, and its picturesque effect enhanced, by the mountain torrent pouring over the precipice into the abyss below, or by the clear crystal lake fed by the Alpine snows.

The effect of sunset is wonderfully increased by a clear sheet of tranquil

water. Then are the gorgeous and ever-changing colors of the sunse duplicated in the bosom of the waters below, forming a second and eq splendid heaven at our feet. Later, when the moon rises, shedding her radiance abroad, she casts her own image in the rippling waters below, ser a broad white track across its surface, and tipping each wavelet with a cre molten, glistening silver, the water mirroring each star in its clear surface. gold, crimson and purple of the sky at sunrise are also exactly duplicated i waters below.

'Tis water that gives color to the sky, for it is water that forms the which composes the clouds, that decompose and reflect the beams of the 'Tis water that makes the rain and the feathery snowflake, the icy envelo twig and stem, that clothes each tree with glistening, sparkling diamonds the sun breaks forth, flooding the landscape in a golden light, renderin whole scene one of fairy, crystal beauty, reflecting from its sparkling surfa the vivid colors of the rainbow. And 'tis also water that forms the halo an rainbow—those brilliant adornments of the heavens above.

How largely a water prospect is sought for in seeking a sight for a co or a rural home, and when nature is deficient, all the skill and art of the landsc gardener is called into requisition to supply the deficiency by artificial m shows the appreciation man has for this feature of nature, so important artistic point of view.

HABITS OF THE SHORT-TAILED TERN.

(*Hydrochelidon Plumbea.*)

E. W. NELSON.

About the middle of May, a person frequenting the prairie portio Northern Illinois, in the vicinity of a prairie slough or small lake, whet the pursuit of birds or in the interest of agriculture, will observe flitting small depressions containing a few inches of water, small flocks of dark-co birds. If the observer has sufficient curiosity, he may pause and watc movements of these shadowy forms.

Flitting from one side to the other of the pool, now pausing and hov for an instant over some floating object, then starting on; again turnin with a graceful sweep forming an almost perfect arc, it picks a luckless i from the water and rises to the height it started from—all with perfect and lightness of movement scarcely excelled by the proverbially graceful low. Presently uttering a few sharp, metallic *criks*, the whole flock, consi of perhaps a dozen individuals, go trooping off across the prairie tow field where a ploughman has just commenced work. Wondering what them in this direction, we follow and soon see that this at least is not o the species to be exterminated by the agriculturist; for, keeping close b

the ploughman, with an occasional eager cry they carefully scan the newly turned sod and every insect brought to light is instantly pounced upon and disposed of without delay. Often they become so oblivious of all but their prey that they approached almost within arm's length of the workman. This habit appears to be common, as several farmers have told me of these birds following them daily through the last of the spring ploughing. As the weather becomes warmer, the small pools in the prairie dry up. The breeding season approaches, and the last of May, seeking the large sloughs, the surface of which is now thickly populated by various aquatic insects, small water-spiders predominating, affords a bountiful table, the terns commence looking about for a site for their future domicile.

About this time the company of intruders is not desired, and a person or animal approaching too near is at once assailed by an angry, screaming cloud, consisting of the entire colony.

They hover about in the air over head, screaming and apparently working themselves into a great passion and making threatening swoops at the cause of the alarm. Finding their cries unheeded, the flock finally disperses with a few discouraged cries and solace themselves with a few spiders which they pick up as they skim along close to the water.

About the first week in June a person approaching the breeding ground is assailed with increased vigor and greater tenacity of purpose; indeed, so energetic do they become that I have seen a small flock attack a cow, coming to drink from the pool in which their nests were situated, and drive her away before she reached the water.

Wading into the shallow water, perhaps knee deep, a short search reveals the nest—a mound-shaped mass of last year's grass mixed with the green blades of this year's growth.

This structure rests securely upon a base some eighteen inches in diameter, and is situated in about fifteen inches of water.

From the base the structure tapers to the rim, which projects from one to two and one-half inches above the surface of the water.

Across the rim the diameter is from four to six inches. In a shallow, saucer-shaped depression in the center the eggs are placed.

During the season of 1875 I examined over one hundred and fifty nests of this species, and in that number less than twenty sets of eggs were deposited upon a mass of floating material, except such as had been collected and heaped up by the parents. These few exceptions were, I think, owing more to lack of time than inclination, since I had twice previously taken the eggs of these same birds from well-built nests, and as the season was by this time well advanced, the birds took advantage of the first suitable place for depositing the last set. In the first set deposited the number of eggs varied from two to four, the latter number occurring but once. Two and three were common numbers. In the second set the number never exceeded two eggs, and in the third set only one egg was found. The nesting habits of this species seems to vary, since, on page

708, " Birds of the North-west," Dr. Coues states—regarding the nesting
species on the Red River of the North—" They (the eggs) had to be c
looked after, for they were laid directly on the moist matting, without an
in any instance, and readily eluded observation, from their similarity in
to the bed of reeds they rested on."

When the young begin to appear, about the middle of June, the paren
extremely solicitous and are very bold in defence of their progeny. One n
bird became so enraged while I was watching one of the young come fro
shell that she twice caught the brim of my hat with her beak and appea
be in such an agony of apprehension that I retired and left her to her
As soon as the young are hatched they are on the lookout for enemies,
was nearly an impossibility to catch one of them on the nest; as, hearir
noise made by wading to the nest, they would take to the water and
rapidly away in different directions, taking advantage of the first large l
aquatic plant to conceal themselves.

If one was approached while swimming it would stop, stretch out its
and lie as low as possible in the water to escape observation. If not noti
would cautiously paddle away; but if seen it would raise its head and
escape by speed.

A young tern, nearly one-half grown, was taken home alive and allov
run about in a large unfurnished room. It was very active and ran r
about from place to place uttering a plaintive "peep." In a short time
came accustomed to its new surroundings and evinced considerable dexte
a fly-catcher. Whenever it saw a fly alight near, it would run at the inse
give a sharp peck, often securing its prey. While running about it di
seem to discriminate between the flies and the heads of the nails in the fl
any other small dark object, but would peck as eagerly at these as at th

The second day of its confinement it became quite familiar and woul
low me from one place to another in the room to take the flies, which I c
for it, from my fingers.

It seemed to enjoy being held and petted, but evinced a great disl
being shut in the box in which it was kept during the night. Owing to
injury the little creature received, it died the second night.

The first week in July the adults commence changing their plumag
their dark coat becomes flecked with white, which gradually replaces the
until by the middle of the month nearly all are indistinguishable, in plu
from the young of the year.

They now leave the sloughs and go foraging along the banks of slow
and reedy ponds and lakes until the chilly weather of fall causes them t
new feeding grounds, and by the last of September only a few stragglers
be found.

THE NIGHT HAWK OR NIGHT SWALLOW.

(*Chordeiles Popetue.*)

The Night Hawk is a very common bird throughout a widely extended area, and in the United States breeding wherever found. Its range extends from Mexico to the extreme northern latitudes, and from the Atlantic ocean to the great western plains. It has been found in Panama, Jamaica, Bahamas and Guatemala. In British America it is common north to Hudson's Bay. The habits and structure of this bird are so different from the Whip-poor-Will that there is no reason for confounding the two birds; they are in everything distinct species. While the tail of the Night Hawk is handsomely forked, that of the Whip-poor-Will is rounded. The wings of the Night Hawk extend to the end of the tail, while those of the Whip-poor-Will reach only to the middle of the tail. The mouth of the Whip-poor-Will is lined with long hairs that reach full half an inch beyond the end of the bill, while the Night Hawk is entirely destitute of these appendages. Such are some of the principal points of difference between the two birds. In habits they are even more widely separated. The Night Hawk is much less nocturnal. While the Whip-poor-Will is seldom seen except after nightfall, the Night Hawk is often observed on the wing even in bright sunny weather, at midday, in pursuit of its insect prey. The Night Hawk is strictly an ærial bird, keeping constantly upon the wing and at a considerable height in the air; while the Whip-poor-Will, on account of its comparatively short wings, is more terrestrial, that is, it does not take such long flights or fly as high as the Night Hawk.

The Night Hawk is not strictly nocturnal, but is rather crepuscular in its habits. It is seen flying at all times in the day and night—in the bright sunshine of noonday, or in the dim twilight of evening. Generally, however, it is more lively just before nightfall or early in the morning. But it is never seen on the wing after dark. It retires to rest as regularly, if not so early, as the diurnal birds—as soon as twilight deepens into the shades of night. Yet, should it be bright moonlight, it is frequently on the wing all night, and its habits seem more regulated by the flight of insects than any organization of the bird itself. The Night Hawk is a bird of strong, vigorous and long-sustained flight. Its motions upon the wing are singularly easy, graceful and rapid. It may be often seen sailing at a vast height above the clouds, like a speck in the sky; at others it is observed darting just above the tree-tops after its insect prey, which it captures in its mouth. At such times it utters a short, sharp squeak at intervals. They traverse the air often so high as to be almost invisible. Moving backward and forward in the manner of a hawk, at times they remain perfectly stationary for several moments and then dart rapidly and suddenly off, their wings causing a peculiar vibrating sound. Occasionally while sailing along at a considerable height the male is seen suddenly to pitch himself headlong downwards with great rapidity for sixty or eighty feet until he

reaches about the level of the tops of the trees, when he will as suddenly and mount to his former level, when he will resume his flight. At the mo of its turning in this peculiar flight the Night Hawk utters a loud, boo sound, resembling the noise produced by blowing into the bung-hole c empty hogshead. This manœuvre is performed at all times and at any it may happen to be in, and not, as some have supposed, confined t vicinity of its nest. The male alone performs this peculiar manœuvre, alth the female has the same manner of flight and the same harsh squeak.

The Night Hawk arrives in Ohio and Pennsylvania about the midd April, and retires south in the latter part of September. It selects dry, situations for its nest—an open glade in the forest, barren heath, wild pas or exposed hillside; it is often near a thick forest, but always open to the It builds no nest, but lays the eggs, which are always two in number, upo bare ground or a few dry leaves. These eggs are elliptical in shape, eq obtuse at both ends. They vary in length from 1.30 to 1.13 inche .84 to .94 inches in breadth. The ground color is a blueish gray, some yellowish white, spotted and splashed all over with shades of slate and lowish brown.

If approached when sitting upon her nest, the female will suffer herse be almost trodden upon before she will leave the nest. When she does tumbles along upon the ground, as if unable to arise or fly, feigning lam until she has succeeded in enticing the intruder to a safe distance fron nest, when she will arise, and to the astonishment of her pursuer, fly off return to the nest.

The great abundance of insects in the vicinity of our cities attracts numbers of these birds. Each summer great numbers are seen flying high the houses in pursuit of their insect prey. They also often lay their eggs the mansard roofs, where they roost at night.

This species begins to lay about the middle of May, in Pennsylv After a suitable situation for the nest has been selected, both parents roc its vicinity during the day upon tall trees, never together and seldom upon same tree. The Night Hawk always perches lengthways upon the branch which it alights, and never transversely as other birds. This is possibl account of the smallness of its feet, which have not the power to grasp limb and sustain the bird's body with sufficient security. When the egg young are disturbed, the parent birds remove them in their mouths to a safe tance. The young are covered with a soft, dense down, and exactly rese the leaves or ground upon which they lie.

When wounded and taken, this bird throws its head forward, open mouth to its widest extent, strikes with its wings and utters a guttural whiz sound, as if to intimidate its persecutor. It never attempts to strike wit bill or claws. Both sexes assist in incubation. From the small size and b ward position of the legs, the Night Hawk is unable to walk easily, or stand erect. It drinks on the wing while flying over the surface of the wat

It is interesting to mark the resemblance and connection different classes of birds have to each other. The Night Hawk, with its large eyes, soft plumage and crepuscular habits, seems allied to the owl; while its long wings and ærial habits connect it with the Swallow and Swift.

The food of the Night Hawk consists of moths, beetles and flies, of which it devours an immense amount.

DESCRIPTION.

Tarsus feathered half way down in front; naked behind and on sides to knee. Head flat on top; bill very small, short, triangular, equal to the hind toe, not quite as long as the diameter of the eye (wanting 1-16th of an inch); eye very large, full and protuberant; nostrils tubular; culmen straight at base, then curved gently down to tip; corner of mouth beneath posterior angle of eye. Tarsus short, same length as middle toe; lateral toes equal, their claws not reaching base claw on middle toe by 2-8 inch. Wings very long, pointed; tertials long and pointed, two inches longer than secondaries and extend to within 2 2-8 inches of end of longest primary. Wing within an inch as long as the whole bird itself. Tail long, forked; its feathers broad, rounded at ends. First wing quill longest; it extends to end of longest tail-feather. The wing is nearly twice as long as the tail. Secondaries all equal length. Tarsi and tibea both together equal to skull and bill in length. Claw on middle toe combed on inner edge; lateral toes joined to middle toe as far as first joint by a web. Hind toe half as long as tarsus. Tarsus half as long as head. Toes all on a level, except hind toe, which is elevated. Frontal feathers advance to inner corner nostrils and extend in a straight line across top of bill. Chin feathers advance to beneath outer corner nostrils. Secondaries cover half of wing. Tarsus covered all around with small plates, those in front the largest, consisting of eight plates. Bill is contained in the head five times. Outlines of the edges of primaries smooth, even and parallel; tips rounded. Depth of the fork of the tail eight inches. Hind toe is inserted a short distance above the level of the other toes ($\frac{1}{8}$ inch.) Extent of wings, 25 inches. Weight, $1\frac{1}{2}$ ounces avoirdupois. The top outline of the upper mandible is straight to the nostrils, when it gently curves downwards. Outline of lower mandible straight to its tip, which curves upwards. Cutting edges of both mandibles smooth. The sides of the upper bill are rounded anterior to the nostrils. From the base to the nostrils the sides are sloping or roof-shaped, forming a ridge on top. A very slight lobe exists on the cutting edges of the upper mandible anterior to the nostrils. Tarsus feathered two-eighths of an inch below the knee; naked behind. The outlines of the tail feathers are parallel to the rounded tips.

The male Night Hawk is greenish black above; slightly spotted, with roundish spots of grayish white and rust color on the top of the head, hind head, hind neck and back. The scapulars and the innermost tertials are thickly mottled and spotted with white and rust color upon a black ground, each

feather having a wide black central shaft spot, its edges ragged, and extenc towards the edges of the feather. Wing covers black, sprinkled with white rust-colored spots. Greater wing coverts black, tipped with a narrow w margin. Primaries, secondaries and tertials brownish black, the five outer v quills with a white spot midway between their tips and the carpal-joint. T crosses both webs on all but the first primary, where it is confined to the ir web. Chin black. Spotted rufous. A white U-shaped spot on the th extends around onto the sides of the neck. A collar of pale rufous on the of the neck extending from the ends of the white crescent on the throat aro the hind neck. Breast black, thickly spotted with white and yellow ruf Rest of lower parts transversely banded with bands of white and black of e width. Two middle tail feathers brownish black, crossed by seven band grayish white. These bands are broken and mottled with black spots. O tail feathers brownish black, crossed by six mottled white bands, as the mi pair, but they have in addition a wide band of white, crossing the feather f side to side half an inch from the tip. On the outer feather this band of w does not extend onto the outer web, but is confined to the inner web; so on the feather next adjoining the central pair. On all the rest it extends c across the feathers. A streak of white and rust-colored spots extends f above the eye to the hind head. Bill black; claws the same.

The female lacks the white subterminal band on the outer tail feathers. white crescent on the throat is replaced by a yellowish rufous spot of the s size and shape.

MEASUREMENTS.

Tip of bill to forehead	5-16 inch.
" " hind head	1½ "
" " outer corner of eye	6-8 "
" " outer corner nostrils	3-16 "
" " end of tail	9 6-8 "
" " end of middle toe	7 2-8 "
" " corner of mouth	1 "
" " chin feathers	⅛ "
Carpal-joint end longest primary	8⅛ "
" " secondaries	3 2-8 "
" " inner tertials	5⅛ "
Diameter of eye	7-16 "
" " nostrils	1-16 "
Tarsus	⅝ "
Tibea	1 2-8 "
Middle toe	⅝ inch; claw, 3-16 in
Outside toe	⅝ " " ⅛
Inside toe	⅝ " " ⅛
Hind toe	2-8 " " ⅜

Tail outer feather - - -	5 inches long.
" middle feather - - -	4 " "
" beyond upper coverts - -	2 2-8 inches.
" " lower coverts - -	1⅞ "
" " end longest primary, -	reaches end of tail.
" " " secondaries - -	4½ inches.
" " " inner tertials -	2 6-8 inches.
" " " middle toe - -	2 6-8 "
Length of tongue - - -	2-8 inch.
Width of tongue - - - -	1-16 "
Height of bill at base - - -	¾ of ⅛ of an inch.
" " upper bill same place - -	2-4 of ⅛ of an inch.
" " lower bill same place -	¼ of ⅛ of an inch.
Width of bill at base - - -	2-8 inch.

Wing Formula :—First or outer, longest; second, 1-16 of an inch shorter; third, 6-8 of an inch shorter; fourth, 1⅛ inches; secondaries, 5 inches shorter; tertials, 2⅞ inches shorter.

BIRDS OF THE NIGHT.

Nature has left no time or place without its peculiar inhabitants. Numerous insects, and many animals that require darkness for their protection, come abroad during the night to seek their food or pleasures. These creatures would multiply to an alarming extent if no check were put upon their increase. Many species of birds have the power of seeing in the dark, and are blinded by the sunlight, thus forced to seek their food in the night. These seem created for the express purpose of an active life in the night. They sleep or dose in some dark, secluded retreat in the forests all day, and do not venture forth until the shades of night have overspread the landscape, when they sally forth, all grace and activity. They seem created for the express purpose of a check upon the nocturnal insects and smaller quadrupeds.

Many insects, not strictly nocturnal, are most active just at sunset, or at twilight. Hence many birds are most active at a late hour—as the Swallows—this period from sunset to nightfall affording them a rich and ready repast. It is after this transition period, when the pall of darkness has closed over the land, that the true birds of the night sally forth. No sooner has the Swallow gone to rest than the Whip-poor-Will, the Owl, and the Bat come forth from their hiding-places, and skim over the country on noiseless, spectre-like wings, like spirits of darkness. The Whip-poor-Will and Bat prey exclusively upon insects, beetles, moths and millers; the small Owls, though they do not disdain a dainty beetle or moth, yet prey more commonly upon the smaller quadrupeds that steal forth to pluck the tender herbage.

Thus, is the night peopled by active beings, who move about and prey noiseless foot or wing.

The birds of the night are of various kinds and species; those of the dissimilar aspects are here brought together. There are some diurnal l that sing in the night, but these are not to be reckoned as true night birds they are not then most active, and seem only to wake up at interval pour forth their strains of melody upon the midnight air. The true night sleeps by day, and only comes forth after the sun has set. Night is their d darkness is their daylight; by day they are dazzled, awkward and at a loss. true nocturnal birds have the wing feathers of a peculiar downy softness, so they move through the air with noiseless flight, like spirits, thus enabling to steal upon their prey unawares. The eyes are large and full, enabling t to see by night; but are dazzled by the glare of the sun, their hearin exquisite, the ear opening generally very large; and the general plumage is full and lax. There is one exception—the Woodcock, who is a nocturnal fe does not possess this soft downy plumage, for the reason that nature r makes unnecessary provisions for her creatures. The Woodcock seeks its on the ground by probing with its bill in the mud, and, as it is not compell seek its prey upon the wing, such a provision for noiseless flight would be less. Neither silence, nor stealth would assist it in its capture of prey.

The principal birds of the night in our country are the following:

Great Horned Owl, Barn Owl, Barred Owl, Long-Eared Owl, Short-E Owl, Great Grey Owl, Bittern, Night Heron, Mottled Owl, Snowy Owl, I Owl (hunts by day, also), Sparrow Owl, Saw-Whet Owl, Whip-poor-Will, N Hawk, Woodcock, Chuck-Will's-Widow.

There is something mysterious and supernatural in these birds, flittin on noiseless, spectre-like wings at a time when the rest of nature is give repose—seeming to turn night into day. They appear to belong almost to other creation—a strange, dark world of their own. Yet they undoubtedly as much happiness and enjoy their existence as the apparently more fav diurnal inhabitants. They are admirably fitted for their mode of life, and w be sadly out of place in daylight.

In the Tuolumne Canyon, California, which rivals the celebrated Yose Valley, is a waterfall which is 1,000 feet high in one unbroken leap. Abo waterfall spreads out at first like a great fan of silvery-threaded water, but, a descent in this shape for two hundred feet, it is whirled over, close changed in color, and shot down a narrow groove worn in the rocks lik arrow of steam. This valley has greater variety of falls, cascades and sl than the Yosemite.

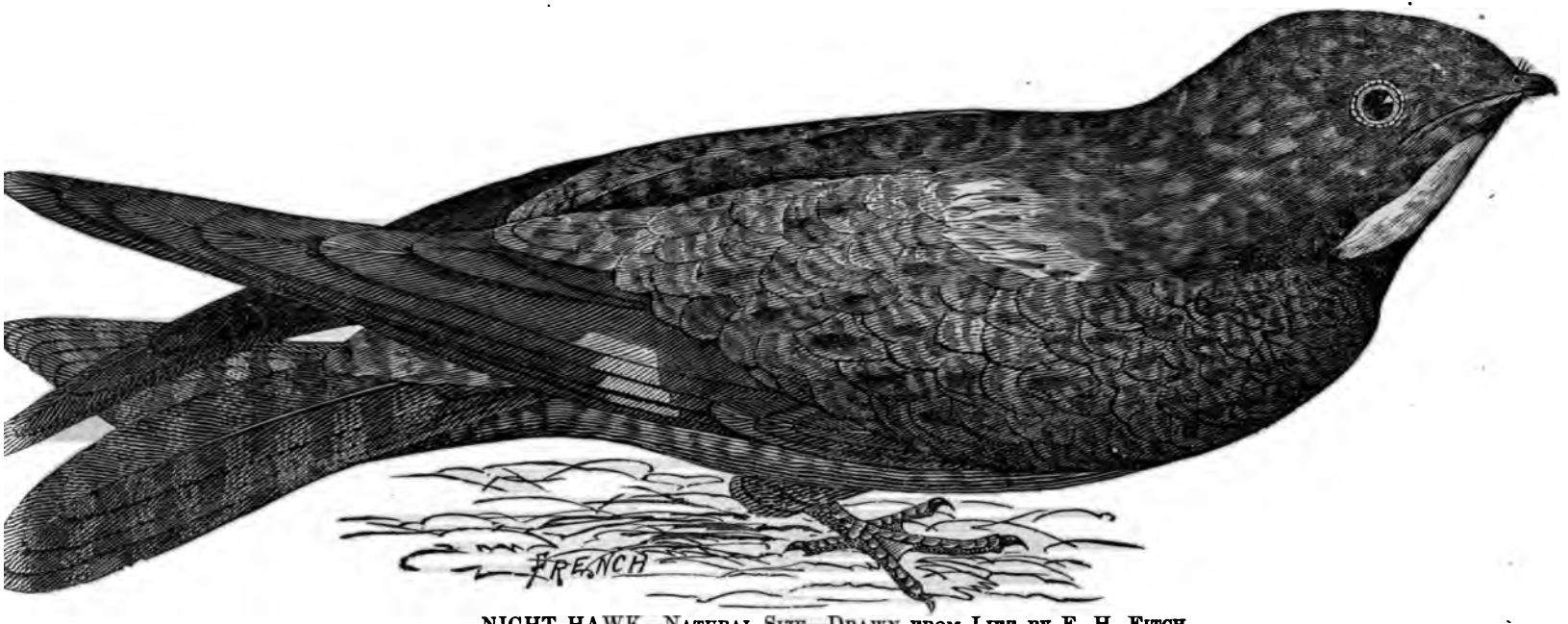
A REMARKABLE CAVERN.

There exists in Dutchess county, New York, a very extraordinary cavern A boy, by chance, passing near its entrance, which lay between two large rocks on the declivity of a steep hill, on prying into the gloomy recess saw the top of a ladder, by which he descended about ten feet and found himself in a large subterraneous apartment, more capacious than he chose to investigate. He soon left the place, but upon the story being told, a party was formed to explore it more thoroughly. They found the cave divided into two separate apartments by a narrow passage, the first being about eighteen feet long and so low that a child of eight years could but just walk upright in it. Its breadth was about ten feet. The second room was fourteen feet long, but much wider and higher than the first apartment. The ceiling, which was quite lofty, was hung with thousands of stalactites, which exactly resemble icicles. These concretions are formed by the water dropping from the roof, which dissolves the rock. They are probably constantly increasing. They have in almost every respect an exact resemblance to icicles, and may be broken off by the hand if not more than two inches in circumference. They are of the consistency of limestone, are almost transparent, and are all perforated quite through the entire length with a small hole, the size of that in the stem of a tobacco pipe, through which the water constantly drops. When a person is in the remotest room and the lights are removed to the first apartment, the effect is singularly beautiful. The pendant drops of water, and the clear crystal-like pendants hanging suspended from the roof, reflect a thousand vivid and changing colors more splendid than can he imagined. Some of these stony icicles have reached the bottom of the cave and thus form pillars, which extend from roof to floor—some more than two feet in girth, of the appearance of marble and as hard. They put one in mind of some cathedral with its vaulted ceilings and carved marble columns, for they are not smooth, but have small depressions and projections, resembling the carved and frosted work upon the capitals and pedestals of those splendid works of man.

The water seems to have a strange petrifying quality, and by a gentle oozing, continually drops from every part of the ceiling, not only forming the thousands of stony semi-transparent pendants and pillars which hang from every part of the roof, but seem to turn to stone everything that it covers.

A skeleton of a large snake turned into solid stone was found upon the floor. It was with some difficulty detached from the rock upon which it lay, an axe being found necessary to separate it, as it was a portion of the rocky bed upon which it was found, remaining attached to it.

In the innermost cavern were found several bats that had there taken up their abode. The temperature was found to be very warm, and the atmosphere close and damp. Although the lights burnt brilliantly, respiration was difficult. The floor was smooth, solid and level, and the walls perpendicular and of hard, polished rock.



NIGHT-HAWK—Natural Size—Drawn from Life by E. H. Fitch.

NANTUCKET.

There is a legend among the American Indians that at one time a and powerful giant was wont to roam about the forests and wilds of England, harassing and destroying the various Indian tribes, until, at becoming exasperated, they, after trying all manner of expedients to become from his attacks in vain, finally, after much fasting, invoked the aid of the G Spirit, who, having listened to the earnest petition of the poor, terrified Ind sent bands of avenging angels to drive him away. The wicked giant, in fright, fled before the pursuing angels into the Atlantic Ocean, dropping a piece of mud from his feet at the place where Martha's Vineyard now is, another which afterwards became Nantucket, these two islands forming the stepping stones of the fleeing giant, who perished in the sea.

Nantucket is an island in the Atlantic Ocean, off the south coast of M chusetts. It is of an irregular triangular form, about fifteen miles long, east west, and of an average breadth of four miles, having an area of fifty-s miles, and contains 23,000 acres. The island is level in the south, and hil the north; the soil is generally sterile, and much of the land is held in comm Although the island contains no mountains, yet it is very uneven, and the hills and eminences with which it is filled, especially at the north, have form the several valleys and ravines many large and small ponds and lakes, sai number fourteen in all. These sheets of water abound in fish of excellent qu and are resorted to by many kinds of water-fowl. Among the low grounds some swamps in which the grasses peculiar to such soils grow luxuriantly. S of these swamps also furnish peat, which is suitable for fuel.

On the south-east of the island are the celebrated Nantucket shoa's, a fifty miles long and forty-five miles wide, upon which many vessels have wrecked; but they serve to protect the island from the great swell and st of the ocean.

The island was first settled by whites in 1659, when Thomas Macy, to es persecution, took refuge there with his family, having purchased the island for £30 and two beaver hats. When first settled the island appears be nothing but the sandy, uneven summit of a submarine mountain, cov here and there with sorrel, grass, a few cedar bushes and scrubby oaks. summer the climate is very pleasant, the heat being tempered by the sea bre rendering it cool and pleasant. But in winter the climate is very cold and terous. The north-west winds render it very bleak and uncomfortable. on the other hand, the social hospitality of the inhabitants, and the abund of good cheer make ample amends for the severity of the season.

The principal town upon the island is Nantucket. It is situated upo north side of the island. Latitude 41° 16' 56" north.; longitude 70° 06' west; fifty miles south-east from New Bedford, and one hundred and five s south-east from Boston. It has a deep and safe harbor, formed by two pro ing points of land, (on one of which is a light-house,) with an entrance bet

the two points one-fourth of a mile wide. The bar has seven and a half feet at low water. This town is principally noted for its whale fishery, of which it was once the leading mart of the world, but of late years this trade has somewhat decreased. The first ship that went upon a whaling voyage to the Pacific Ocean sailed from Nantucket in 1791. After the close of the Revolutionary War, the flag of the new-born Republic was first seen in the River Thames flying from the mast-head of a ship from Nantucket.

In the year 1846 a great fire destroyed three hundred and fifty buildings in Nantucket. On the south-east end of the island is the village of Siasconset—about seven miles from Nantucket. This is a noted watering-place. On the island of Nantucket are nine churches, several fine public schools, and many good hotels. The docks are good and substantial. The population of the whole island is about 6,100, almost all of which is contained in the town of Nantucket.

THE FALLS OF TALLULAH.

The Tallulah River, upon which are situated the celebrated falls of that name—which, by the way, means "the terrible"—rises among the Alleghany Mountains and is a tributary of the Savannah. Its entire course lies among mountains, grottoes and ravines, and is replete with romantic and grand scenery. It is emphatically a mountain stream—clear, deep, cold, rapid and narrow, and subject to every variety of mood. In fact, some of the most varied and picturesque scenery in the world is found in the hilly and mountainous regions of Georgia, South Carolina and North Carolina.

During the first half of its course the Tallulah River winds among the hills as if dissatisfied with its lot and seeking an escape to some new and more suitable home. Soon it flows placidly along for several miles, so calmly that one can scarce hear its ripple; but tiring of this peaceful course, it gathers itself together, narrowing its banks for an approaching and exciting contest, and runs through a chasm whose walls for about four miles in length are for the greater part perpendicular, and after making, within the space of half a mile a number of leaps as the chasm deepens, it now settles into a turbulent and angry mood, seething and boiling as it pursues its way for a mile and a half further, until it leaves this chasm and regains its former character. The falls of Tallulah are really five in number, called Lodora, Tempesta, Oceana, Honcon and Serpentine. Their respective heights are 45 feet, 100 feet, 120 feet, 50 and 30 feet, making, in connection with the accompanying rapids, a full descent of 400 feet within the distance of half a mile. At the point of these falls the river is particularly winding, and the high cliffs of solid granite on either side, which are perpendicular, vary in height from 600 to 900 feet; while the mountains which back the cliffs rise to the height of 1,500 feet. Many of the pools are very large and deep, while the rocks and walls in their immediate vicinity are covered with luxuriant moss, making them always green. The vegetation of the whole

chasm is remarkably rich and varied. Here we find the noble pine wit towering head, together with the more modest trees, in great profusion. also are lichens, mosses and ferns, with a great profusion and variety of fl and vines. Through this immense gorge the wind rushes with great force times, and the sun never falls upon the cataracts without forming beautiful bows, which contrast in their vivid colors with the gloomy and rugged of the surrounding rocky chasm; while the roar of the cataract and the ris ing clouds of vapors mount up to heaven, calling upon man to admire wonder.

Among the other natural curiosities of this romantic gorge are grotesque pinnacles, rocks, caves and cliffs. The Devil's Pulpit is a ro overhanging cliff, full 600 feet high. The view from its perilous height is ticularly grand and imposing, stretching far up and over this wild and tastic gorge. The Devil's Dwelling is a small cave about 20 feet dee occupies a very conspicuous position in the side of the cliff overlookin Honcon fall. Its situation is near the summit of the precipice. Near the of this cavern is a singular rock, which resembles the figure of a woman sitting position, who is said to be the wife of the owner of the cavern a the way.

The Eagle's Nest is a projecting rock from the brow of a beetling cliff s hundred feet high, perfectly perpendicular.

The Deer Leap is the highest cliff in the whole chasm. It is 900 feet From its summit to its base it is without a fissure or an evergreen, and as sm as if polished and planed by hand; and over its brow tumbles a tiny stre the most beautiful and graceful manner imaginable. This scatters upon rocks below in the greatest prodigality, resembling in the sunlight the s diamonds and pearls woven in wreaths of foam, and spray of crystal drops obtained its name from the circumstance that a deer once sorely pressed pack of hounds, was pursued and driven to this point, and in its terror cle the rock with one great leap and perished in the depths below.

Hawthorne's Pool, a deep crystal lakelet, is so named from the fact th young and accomplished Englishman lost his life while bathing in its wa There is an Indian legend connected with this place, which is related by C Laman: "Many generations ago it so happened that several famous hunters, had wandered from the west towards what is now the Savannah River, in s of game, never returned to their camping grounds. In process of time the osity as well as the fears of the nation were excited, and an effort was ma ascertain the cause of their singular disappearance. Whereupon a part "medicine men" were deputed to make a pilgrimage towards the gre They were absent a whole moon, and, on returning to their friends reported that they had discovered a dreadful fissure in an unknown part country, through which a mountain torrent took its way with a deafening They said that it was an exceedingly wild place, and that its inhabitants we species of *little men and women*, who dwelt in the crevices of the rocks and in

grottoes under the waterfalls. They had attempted by every artifice in their power to hold a council with the little people, but all in vain; and from the shrieks they frequently uttered, the "medicine men" knew that they were the enemies of the Indian race; and therefore it was concluded in the nation at large that the long-lost hunters had been decoyed to their death in the dreadful gorge which they called Tallulah, *the terrible*. In view of this little legend, it is worthy of remark that the Cherokee nation, previous to their departure for the distant west, always avoided the falls of Tallulah and were seldom found hunting or fishing in their vicinity.

One other Indian story is current as connected with this romantic locality. An Indian maiden had fallen in love with a brave and handsome young warrior of another tribe with whom her own clan were at war. They met by stealth many times, but at last they planned an escape and fled. They were pursued by the girl's father and his followers until, reaching the brink of the precipice on the Deer's Leap, they stood for a moment clasped in each other's arms, when with one wild shriek they cast themselves into the seething abysses below, and their bodies were found there afterwards, still in the embrace of death.

So prolific were the Indians of legends and stories that scarce a nook or corner of our land is without some story of tragic end. Many an interesting tale, full of the most tragic incidents, might be related of the life of the American Indians.

A NATURAL BRIDGE.

In the township of Adams, Berkshire county, Mass., not half a mile from Stamford, in Vermont, is a natural curiosity that merits description. A stream of water called Hudson's Brook, which, rising in Vermont, falls into the north branch of Hoosack River, has for thirty or forty rods excavated a very deep channel through the solid rocks, which here are white marble. The hill, gradually descending to the south, finally terminates in an abrupt and steep precipice, over which the stream probably formerly tumbled; but finding in some place a natural chasm in the rocks and in others wearing them away, as is evident from their appearance, it has formed a channel which in some places is more than sixty feet deep. Over this deep channel, at its deepest portion, some of the rocks remain and form a natural bridge. From the top of this bridge to the water below it is fully sixty-five feet. Its length is about fifteen feet and its breadth ten feet. Partly under this bridge and about ten or twelve feet below it, is another, which is wider but not quite so long, for at the east end they form one body of rock fourteen feet thick, and under this the water flows. From many indications, it is evident that the water in some places formerly flowed fifty feet above its present level. Many caverns and smaller cavities of different sizes and shapes, but generally circular, are worn in the surface of the rocks. One of these in the solid rock is four feet in diameter and five feet deep. The

rock is on one side worn through at the bottom so one can hear the water ripples underneath. A short distance above the bridge on the west side of chasm is a cave or room, which has a convenient entrance on one side passage out on another. From the west side of this cave a long, narrow winding passage leads into the hill, but soon becomes too narrow to pass. rocks at this place are mostly white, but are in some places striped, of v colors, producing a striking and peculiar effect.

THE CLIMATE OF ALASKA.

The climate of Alaska is by no means as severe as that of corresp latitudes upon the eastern coast of North America. The weather is thou be mitigated by the Japan Current, an ocean stream somewhat similar Gulf Stream of the Atlantic Ocean, which tempers the climate of the Islands, rendering them mild and pleasant, although in the latitude of foundland. The Territory of Alaska is divided naturally into three regi regard to climate—the Yucon district, comprising all the country north Alascan Mountains; the Aleutian, consisting of the islands of the sam and the Peninsula, and the Sitka district, comprising the remainder of th ritory. In the Yucon district the mean annual temperature is about 25° and the ground remains frozen to within two or three feet of the surface thr out the summer. In winter the ice on the Yucon, which is the principal of Alaska, averages five feet in thickness, and when there is sufficient freezes to the depth of nine feet. The Summer is short, dry and hot. June and July constitute the pleasant season. After July the rainy seaso in, and lasts until October. The lowest temperature ever recorded in thi trict was 70° Fahr. The climate of the Aleutian district is more mild, tempered by the sea, the mean annual temperature being from 36 to 42° The average annual rainfall is about 40 inches, distributed among 15 days in each year. January, February and June are here the pleas months. In the Sitka district we find a still warmer and moister clima fact, the town of Sitka is said to be the rainiest place in the world outs the tropics. From 60 to 90 inches of rain falls annually, and the numb rainy days in each year from 190 to 285. The mean annual temperature i but the average temperature in winter is proportionally much higher t summer, being only a little below the freezing point, while the continu excessive rains in the Summer make that season unduly cold. Ice fit f rarely forms in Sitka. The agricultural resources of Alaska are practicall fined to the Aleutian and Sitka districts—in the interior, the summers too short and dry and the winters too cold. The abundant growth of perennial grasses in the valley of the Yucon affords rich fodder for cat no grain has yet been raised, and the only vegetables that have succee turnips, radishes and lettuce. The most fertile land is found on the Al

Islands and at Cook's Inlet on Kodiak Island, where oats, barley and root crops are raised. Yet in the most favorable localities in Alaska the crops can never exceed the demand for home consumption. The chief industry and source of wealth must ever be the fisheries and the fur from seal skins. One hundred thousand seals are caught annually in the waters of Alaska alone, valued at $1,200,000. The fur seal is taken mainly from two small islands in Behring's Sea. The sea otter, which is also valuable for its fur, is taken mainly from the Aleutian Islands. The fur seal trade of the two islands of St. George and St. Paul, which are situated 300 miles from any other land, is thus a valuable and special trade. The seal catching is done mostly by the natives, who bring them to market to trade for the necessities of life. Sitka is the great seal mart, where the exchanges are made. The seal animals resort to these islands in May and November for the purpose of reproduction—rearing their young and shedding their hair. When winter approaches they all migrate and are not seen again until the next spring. During the summer millions of these animals line the shore for miles, and although thousands are killed each year, they do not seem to decrease in numbers. The United States have passed laws regulating the killing of seals, prohibiting their destruction by any one except in the proper season, and none but males being allowed to be destroyed. The seal islands of St. Paul and St. George are leased to the Alaska Commercial Co. of San Francisco. The number of seals they are allowed to kill is limited to 100,000 a year. This entire product is sent to London, and there sold at the great semi-annual auctions. The company are under heavy bonds and penalties to observe the laws of Congress, regarding the time and mode of killing these animals. They have the exclusive right to kill seals on these two islands, but all other game and fur-bearing animals can be taken by any one, and the general fur trade is open to free competition. The total annual fur seal catch of the entire world is said to be 160,000, of which Alaska alone produces 100,000. The seal is nearly exterminated elsewhere. Some of the houses of the natives of the Aleutian Islands are under ground, the only opening being by a ladder formed of a post, with pegs stuck in it at intervals, which stands up perpendicular in a hole in the roof. In these subterranean abodes the natives live, sleep and eat, the only opening for smoke, light or air being the one passage-way in the roof.

A NATURAL TUNNEL.—In Scott county, Virginia, is a subterranean channel which runs in a serpentine direction completely through a large, rugged limestone hill. The entire bed of this tunnel is traversed by a running stream about twenty feet wide. The tunnel itself is 450 feet long, from 60 to 80 feet high, and about 70 feet wide. On either side of the hill through which the tunnel passes are perpendicular cliffs, some of which are 300 feet high and exceedingly picturesque. The gloomy aspect of this tunnel, even at bright noonday, is very imposing; for, when standing in the center, neither of its outlets can be seen, and the darkness of the interior, together with the hollow echoing sounds, makes a person feel as if transported to the bowels of the earth.

THE PAPER NAUTILUS.

(*Argonauta Argo.*)

A visitor to the Mediterranean Sea may see floating upon the quiet a curious and beautiful object. It appears exactly like a tiny bark or with two silken sails spread to the breeze and frail oars dropped over the of the sail boat. This strange and delicate little bark, no larger than a hand, of exceedingly beautiful form and of delicate color, floating graceful the transparent waters, is a very interesting sight; for the little animal is a veritable living animal) are very fond of sunning themselves floating upon the surface of the tranquil waters.

This strange little being is the celebrated Paper Nautilus or Argonaut often introduced in poetry and prose. It is a species of polupe or cuttle without any skeleton. The little creature lives in its shell, which is boat-shaped and the animal has the power of floating quietly upon the surface or sinking the bottom of the sea at its will, where it runs about with its shell, into which can retreat entirely at its pleasure, and which is both its boat and house, on its back. The Nautilus is very voracious, and may be tamed so as to be fed the hand, then forming very attractive pets. In their native state they are timid. When they perceive any danger, or are aware of being observed, they immediately draw in their sails and oars and sink to the bottom. If much alarmed they eject a dark inky substance upon the surface of the water, forming a cloud under which they endeavor to escape. It has been discovered that if the shell is broken, the animal will set to work with its two sails (or, as he uses them for various purposes, we will call them hands,) to mend it; that it will not only mend cracks but replace parts broken away by the same material of which the rest of the shell is composed. In making these repairs, it often appropriates pieces of shell that may come in its way and solders them in to fill the crevice. The first day the new shell is formed it is as thin and delicate as cobweb, but it soon hardens and becomes perfectly firm, and as shelly as the original part. It takes about thirteen days to become as hard and firm as the original shell. This process is performed by spreading a secretion formed and exuded from the body of the animal by its two sail hands over the part that is or lost.

The Nautilus has eight arms, provided with suckers. Two of these are expanded into broad membraneous webs, with which the creature grasps the shell when it is swimming, and by means of which it forms and secretes its shell. These are what appear like sails spread to the breeze, as the animal floats the shell upon the water. The shell of the Argonaut is boat-shaped, deeply grooved, very thin, transparent, and so flexible that its sides may be pressed together. It has no muscular attachment to its shell; hence it was formerly supposed that the animal took up its residence in a cast-off shell of some other creature; but it is now well ascertained that its shell is formed by the membranes above

tioned, which have the power of secreting the substance of which the shell is composed.

The little animal is very sensitive and timid, and sometimes in its fright it becomes separated from its shell, and consequently dies; but it occasionally voluntarily quits its shell and again resumes it. When in its shell there is always a rather large vacuum at the bottom.

The Argonaut is an inhabitant of various seas in warm climates, but is most common in the Mediterranean.

When disturbed and the ink bag is emptied, the Nautilus will spurt water from the funnel as long as pursued, if it cannot hide in the mud.

The eggs are small, like millet seeds, transparent, attached by filaments of brilliant glutin to a common stem of the same. Three days after the eggs are discovered the little poulps are observed in the shell, like small worms. Soon after, they begin to show buds with two rows of points upon them, the rudiments of the arms and suckers. The hands, or sail arms, always appear first by two or three days. On the sixth day the first sign of a shell is observed, very thin and flexible. The eggs are found in the interior of the spire of the parent; the young between the roof of the spire and the mantle. The infant shell seems first to be deposited in the end of its parent's spire, whose form it thus assumes; but after a while it carries on the process without aid. Two or three eggs are developed at a time. When the young are about three-quarters of an inch long they inclose themselves in the spire of the parent, where they remain four days to acquire the shell. Three days more they remain under the body of the mother, and are then ejected.

The skin of the Nautilus is soft and includes a great number of cells, containing a pigment matter of different colors, whose contractions and expansions give rise to its power of suddenly changing its color. The largest specimen of Paper Nautilus ever found was 10 inches long, 6½ broad, and the opening was 4 inches wide. So rare are these little beings, that a fine shell cost Dr. Warren, of Boston, $500. This was donated to the Boston Society of Natural History.

Swimming is effected in this species in a retrograde manner by the ejected currents from the funnel. In walking the shell is carried upon its back. It walks by means of its suckers, which are completely within its control. The shell is used as an incubating and protecting nest for the eggs.

The food of this species consists of other mollusks and crustaceans, showing that its natural habitation is the bottom of the sea.

The eyes are large; gills two, each with a branchial heart; rudimentary external ears; tongue with many papillæ; crop capacious; gizzard oval.

It is a curious fact that all the different specimens of Nautilus hitherto discovered have been females; hence it is supposed that the males are of a different form, without shells.

Four species are now known, all closely resembling the one we have figured and described.

The males are only ⅓ of the size of the females and are without shells.

Egg of Night Hawk
(Natural Size.)

A STRANGE BUTTERFLY.

About one hundred thousand years ago, during the decline of the ice p a colony of butterflies settled in New England. They chose for their ter Mount Washington, in New Hampshire, and their descendants occupy the summit of that mountain to this day. Mount Washington is 6,293 feet and the White Mountain butterflies are not found below an elevation of 5,600 feet. Between this height and the cloud-capped summit, the butt disport during the month of July of every year. The bare and inhosp summit affords little vegetation, but the White Mountain butterflies find food upon which they thrive. Both Mr. Sanborn and Mr. Scudder have the caterpillar feeding upon the sedges which grow, as best they may, i lows and between the rocks. The brown butterfly which succeeds the cater measures about one and eight-tenths inches from tip to tip of the extende wings. Above, the wings are feebly marked; beneath, the hind wing crossed by a dark median band with its outer edges deeper brown and irre while beyond the band the wings are marbled, brown and white. Natu know the White Mountain butterfly by the name of *Oeneis semidea*, and its biographer was Thomas Say, who described it in the year 1828. Previ Mr. Thomas Nuttal, the botanist, had collected specimens of the butterfly, Say's original figure of the species was drawn from an individual present him by Mr. Charles Pickering, of Salem.

It is 1800 miles west from Mount Washington to Long's Peak, Colo In this direction, over all the level stretch of country, no butterflies lik White Mountain butterfly are to be met with. But in Colorado, species si to the White Mountain butterfly, if not exactly like it, are found again oc ing elevated lands. To the northward it is 1000 miles to Hopedale, Labr and here again very similar butterflies are found living in that northern re

This is a strange distribution for a butterfly, and so the question com as to the manner in which it was brought about. By comparing what has found out with regard to past conditions of the earth and the present sta things, a solution of the question has been offered. This solution gives t ice period in North America as the agent which has induced the present c bution of the genus to which the White Mountain butterfly belongs. An colonization of the butterfly on our New England mountains would have effected in this wise.

Before the ice period commenced in New England, it had gather the extreme north of the continent. The ice gradually and very slowly vanced year by year to the southward. Always more snow fell than was m and this snow stayed summer and winter, and accumulated more and more consolidated into *neve* and glacial ice. Forming on the highest lands, the rivers filled the ravines and joined upon the plains the main body of ice w was pressing southward from the pole. Summer and winter still alternated as is the case now at the extreme north, the summers were short and the wi

long. The advancing ice destroyed or drove before it the insects and animals of the warmer climates, which it chilled by its approach. But it was kind to its own children. It brought down with it its *Oeneis* butterflies and its reindeer. Before its feet it spread food for both of these, year by year, always pushing food and animals to the south. At the probable rate of less than a mile in a hundred years, it brought them at last into Virginia, from the farthest north; not the Virginia of to-day, but the Virginia changed into an Arctic scene.

At length the climate changed. The point of farthest advance reached, the ice began to retrace its steps. And it called its own back with it, alluring them by their food, scattered ever farther and farther to the north. At some time the lengthening summers and shortening winters brought the main ice sheet back into New England. From Southern New York to Connecticut, to Massachusetts, to Vermont, to New Hampshire, it retreated all the way. It was as the retreat of an army with all its baggage and equipments, and in perfect order. Year by year it called upon its plants, its butterflies, its animals, and they followed in its royal train. It had overridden all obstacles, all lives and constitutions, and in its retreat it shed over the lands which again saw the sun, floods of water, the source of fresh life and civilizations. But it was careful of its own plants and animals; they were to go back with the ice, nor be seduced by the lakes and streams its retreat unveiled, and so become companions to the mammoth. And it succeeded, for the most part, until it reached the White Mountains. Though year by year the individual butterflies perished, they planted their successors; the longer lived reindeers laid their bones by the way, and in the Connecticut Valley itself, but fresh herds still were ready to follow the northward march of the great glacier.

Out of the Valley of the White Mountains the main ice mass gradually retreated; and here it lost some of its followers. At that time the White Mountains must have presented an appearance not unlike the Alps of to-day, an aspect which, owing to their inferior elevation, they have since lost under a climate growing in warmth. The local glaciers, which then filled the ravines, attracted some of the wayward, flitting *Oeneis* butterflies by a display of the food plants which they had harbored and obtained from the main glacier. Year after year the great glacier retreated farther and farther north, followed by the main body of its train,—plants, butterflies and animals,—the while some of these foolish butterflies were beguiled by the shallow ice-rivers which then filled the ravines of Mount Washington. Return became at length impossible. They advanced behind the deceiving local glaciers step by step up the mountain-side, pushed up from below by the warm climate, which to them was uncongenial, until they reached the mountain-peak, now bare of snow in the short summer. Here, blown sideways by the wind, they patiently cling to the rocks. Or, in clear weather, on weak and careful wing, they fly from flower of stemless mountain-pink to blue-berry, swaying from their narrow tenure of the land. Drawn into the currents of air that sweep the mountain's side, they are forced downwards, to be parched in the hot valleys below. Yet they maintain themselves. They

are fighting it out on that line. They are entrapped, and must die out the natural causes unless certain entomologists sooner extirpate them by pi them up in collections of insects. What time, in Tuckerman's Ravine, the ill-advised collector, net in hand, swooping down on this devoted colo ancient lineage and more than Puritan affiliation, I wonder if, before it late, there will not be a law passed to protect the butterflies from the cu of their pursuers.

This is the story of a colony of New England butterflies. I commen colony to the protection of all good citizens.—*Prof. Grote.*

OZONE.—Ozone is a kind of gas formed from oxygen, often by electr The air of the country contains an odoriferous and oxydizing principle, imparts to it a peculiar odor, and the power of changing iodized red li paper to blue. It also possesses the property of destroying certain bad s and decolorizing blue litmus-paper without previously reddening it. Oz more abundant and its effects are more apparent in the free, open country in towns and cities. It exists in the air normally, but the intensity with wh acts at any given point of the atmosphere is often variable. The air of the co contains, at the most, about $\frac{1}{480,000}$ of its weight, or $\frac{1}{100,000}$ of its volume, of o Moreover, the manifestations of ozone upon the litmus-paper are more fre and intense in the country than in the city. It is also greatest in spring, s in summer, weaker in autumn, and still weaker in winter. In rainy ozone shows itself most frequently, (forty-eight ozone days in one dred of rain to twenty-eight in one hundred of fine weather.) Winds, according to their strength, exert a greater or less effect upon the manifesta of ozone, (twenty-four ozone days in one hundred in calm days to sixty i hundred when the air is greatly disturbed.) In general, when the atmos is greatly disturbed by perturbations, as storms, gales, etc., ozone manifesta are particularly strong and marked. It is also noted that these great pert tions of the atmosphere exert an effect upon ozone at a great distance fro place where they are felt, the ozone of towns and localities at great dist from the storm being affected while it is enjoying calm weather. Atmosp electricity appears to be an active agent in formation of atmospheric ozone

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From recent surveys it has been ascertained that the climate of the Ale Islands is found to be mild and uniform, not as cold as Philadelphia; bu barometer is subject to many and extreme fluctuations. It was found tha fauna and flora do not exhibit Asiatic influences in a western direction, b the contrary, become more Arctic and meagre in their character, until, a as on the westernmost island, they are almost entirely Arctic. The thermo did not fall below 10° Fahrenheit during the whole winter, although i unusually severe.

CLOUDS.

Clouds are one of the chief adornments that render our earth so charming. A sky without clouds would soon become monotonous and tire us by its sameness, its ever unchanging expanse of unvarying blue, without one spot or contrast of color to relieve its monotony. It is the clouds that lend a charm and agreeable variety to a scene. By their fleecy and ever-changing forms, their variety of colors, tints, and shapes, they give a great diversity and ever-delightful aspect to the heavens.

Clouds, weather streaking the blue expanse of heaven by long, fleecy and delicate whisps of white, piled in dense cottony masses and heaps, dappling the ethereal firmament with small, semi-transparent white spots, or piled in dark and angry heaps near the horizon, are ever an agreeable concomitant to the landscape. But when decked in the vivid and ever-varied and changing colors of sunset, from the intense and deep crimson and gold, to the green and blue, purple and indigo, in all possible combinations, they become such marked and glorious objects as to excite our wonder and admiration; also, when tinted with the gold and crimson of sunrise, or when streaked with all the varied colors and tints of the rainbow, in broad bands radiating from the setting sun, they are objects of great beauty, and lend a variety and richness of coloring and form to the landscape, without which the scene would lose a great part of its interest.

Clouds are ever changing in form, shape and aspect, assuming so great a variety as to excite our wonder and interest, sometimes resembling castles or cities with their towers and pinnacles, spires and cupolas, at others the forms of crumbling towers and extensive ruins, of vast forests or mountains and plains seem plainly spread before us in the sky. The forms of animals or birds are clearly pictured in various and striking attitudes upon the blue background of the heavens. Often when the sun is obscured by the intervention of a thick bank of clouds, they will suddenly partially open and we seem to gaze down deep between their environing walls into some long and narrow passage between the cloud masses, through which of a sudden will shoot a single bright beam of light, like a dart of fiery matter, illuminating the landscape in a sudden gleam of brightness and glory.

Clouds appear to exercise a powerful effect upon the mind of man, with which they seem to be intimately connected; when the sky is overcast by gloomy grayish masses, and the sun hid by a veil of darkness, the landscape becomes dull and gloomy and the mind and temperament of men seem to become alike gloomy, dull and despondent.

But when tinted with the golden and crimson light of the sun, or when sailing across the bright blue heavens in soft, white, fleecy masses, they cheer the spirits and please the fancy by their changing forms and colors.

In calm weather, where water is abundant, the lower strata of the atmosphere becomes laden with the extreme amount of moisture comportable with their temperatures.

If saturated air becomes cold by contact with a solid body, it deposits the surface of that body a portion of its moisture, but when the cooling pr takes place in the midst of the vapory mass, the moisture that is set free p off in small floating vesicles that constitute clouds and mists.

Sometimes only the surface of water is covered by mists, because water vapor which becomes condensed in the air which lies over them and bec cold after sunset; while the land, being dryer, does not evaporate so rapid

Clouds are bodies of moisture in the atmosphere. The heat of the s continually evaporating the moisture from the surface of the earth, lakes, ri oceans and ponds. From these, aqueous vapors are continually ascending int atmosphere, where they remain in an invisible form until the atmosphere bec saturated with moisture. Its capacity in this respect is varied—the gr the temperature the more the particles of vapor are distended and the h they are carried. Cold condenses the particles; their specific gravity is incre and they become visible. Saturated to the utmost, the atmosphere cannot tain more than six or seven inches of water diffused through it in an inv form at one time. Where the vapor is not too abundant for the existing te rature, it is all dissolved and the sky appears clear and blue. When the ture is in excess for the temperature, it is seen in the form of clouds, thin fleecy if only slightly oversaturated, but dark and lowering if much saturated; or the reduction of temperature increases the difference betwee moisture present in the atmosphere and the capacity of the air to reta Thus the conditions are plainly seen by which the different appearances o clouds are occasioned: why the moisture-laden clouds as they sweep ove sea are dispersed in thin air as they strike the hot atmosphere over the S Desert, or why the clouds filled with moisture are condensed into rain or as they are borne by the winds and currents of air against the cold summ mountains. Thus clouds are formed by cold and broken up and disp by heat.

The air being colder around the summits of mountains, the vapor o atmosphere is condensed and a continual belt of cloud is formed, which fill place of the clouds wafted away by the winds. Thus a belt of clouds is rally seen around mountain tops, though electrical attraction may have s thing to do with it. Aqueous vapor being a better conductor of electricity the dry air, the clouds gather this force from the atmosphere around them, strata being positive and some negative. So, also, the ascending vapors the surface of the earth gather and carry up electricity into the clouds.

The clouds when separated by a dry atmosphere, or the clouds an earth, seem, like the Leyden Jar, ready to be discharged with sudden r when the non-conductor which separates them is broken through. A clouds thicken, the watery particles press more closely together, the elect contained in the whole mass of the cloud tends to gather upon the surface as the vapors condense into rain, it is more copiously evolved, acquiring tension to break through the non-conducting medium, and then the elect

equilibrium is established by the flash of the lightning and the roar of the thunder.

An interesting feature in the study of the clouds is the fact of their gathering in the equatorial regions in an immense belt, that encircles the globe and remains permanent and of nearly uniform breadth.

This vast cloud belt covers the region of equatorial calms, and is occasioned by the vapors gathered and brought in by the northeast and southeast trade winds, from both sides of the equator, and diverted into the belt of calms, where they meet into the upper regions of the atmosphere.

There, continually fed by the new supplies of heated and moist air from below, the cloud spreads in one vast and dense veil over the earth, forming a screen which protects the earth from the fierce rays of a tropical sun, and a great reservoir, from which copious showers moisten the earth. Immense volumes of vapor upon its upper surface, exposed to the direct rays of the sun, are retained in an invisible form, and are in this condition, borne by the winds and currents of air, to reappear as clouds and precipitate their waters upon distant portions of the earth.

This equatorial belt vibrates within the belt of calms, from one side of the equator to the other, its range being from lat. 5° S. to lat. 15° N., its width is from sixty to several hundred miles.

As to clouds in general, they are higher within the tropics than in the temperate zones, and usually higher in summer than in winter.

When clouds form near the surface of the earth, they are called mists. How clouds are sustained in the air, and what holds them suspended there is a mystery yet not definitely ascertained. The general opinion is that clouds consist of minute globes, or bubbles of water, hollow inside and filled with air, and buoyed upwards by ascending currents of heated air. So long as these watery shells retain the air they are sustained, but as soon as they collapse and collect in drops they descend in rain. It has been found by actual microscopical measurements that the diameter of these minute hollow spherules of mists is about .00087 of an inch, and that it varies in different seasons, being twice as great in winter, when the air is very moist, as it is in summer, when the atmosphere is dry. It also varies in a month, being larger when moist weather prevails. The range in size is from .0055 of an inch to .0134 of an inch.

During the day the atmosphere is constantly traversed by warm ascending currents of air which rise with a speed of several yards a second. If it were not for this, the little spheres of mist would descend. Left to themselves, these tiny globes would fall. Experiments show that it would take more than half an hour for them to fall a little more than one mile in the atmosphere; that is, they descend at the rate of one yard per second. On account of these constantly, but invisible and unfelt ascending warm currents, the clouds would not descend by day except the circumstances be exceptional. At night the clouds are nearer the ground.

There is a constant change in the particles which compose a cloud, so t as a matter of fact, a cloud is continually changing its shape, thickness and s stance. The lower surface of a cloud dissolves as it descends into warmer and frequently the upper surface also when exposed to the rays of the sun that the ascending particles from below and the descending central globu occasion a constant current or movement through the cloud.

To form rain there must be two layers or strata of clouds, one above other—the upper an ice cloud. Under such circumstances, the least declin temperature sets the watery spheres in motion and destroys them. The l diminution of temperature precipitates them in the form of rain. The ordi condition for the production of rain, therefore, consists in the existence of layers of clouds, one above the other, and it is the upper which causes precipitation of the lower. These two forms of cloud are of opposite electric the colder and higher cloud, which condenses and precipitates the moistur the lower and warmer cloud, being of an opposite electrical state to the ur cloud.

This explains why sometimes, when the sky is overcast with thick clo no rain or snow falls. There is no upper strata of cold clouds.

Clouds are masses of vapor floating in the atmosphere at different dista from the surface of the earth. They exhibit an endless diversity of outline, sity and color, sometimes accumulated in dense masses or heaps, at ot dappling the heavens in thin fleecy streaks or spots.

They may be divided into three classes. The cirrus (cat's tail of sail the cumulus (ball of cotton of sailors), and the stratus (fall cloud.)

1. The cirrus, or "cat tail," is composed of thin filaments, of feathery f and in wisps of diverging fibres, it extends in long slender filaments, par stripes from one extremity of the heavens to another, or in delicate and sle network. The cirrus appear in the higher regions of the atmosphere, and the most elevated of the clouds. From the summits of mountains, where look down upon the other clouds, the cirrus clouds appear elevated in the floating as far off apparently in the blue ether as when observed from the pl at the base of the mountains. Their great elevation and feathery form sug that the vapor exists in snow flakes, and this is apparent from the occurren such phenomena as halos, parhelia, etc. Usually in these clouds, trace halos, such as are formed by the refraction of light from frozen parti may be discovered by careful examination. The long filamentous f of this class of clouds is probably due to currents of air in the upper reg of the atmosphere, maintaining uniform temperature along their lines, drawing out in these shapes the residues of dissolving clouds. Variat in these currents of temperature or direction impress new forms upon cirrus clouds. The diverging fibres are the true form of this cloud, and are posed to indicate a change in the weather—in summer, rain and wind; in ter, frost or snow. If the fibres have continued to point in one directio

some time, a gale of wind is looked for from that direction. The mean heigh of these clouds is from twenty-five to thirty-five thousand feet. By mean of their very constitution—being composed of icy and snowy particles—the remain in the upper and etherial regions of eternal snow. But as the zone o 32° varies in height according to climate, season and latitude, it follows tha these clouds may make their first appearance in the lower regions of the atmos phere in the frosty latitudes of the poles, and even in our latitudes during sever cold weather. They are nearly always divided into long, narrow, straigh stripes, or wisps, and white in color.

Sometimes the white color of the cirrus cloud becomes dimmed, their strio interlace each other, and they become denser, more compact and heavy, becaus the upper air is moist. In this case they look like carded cotton, and thi change generally foretells rain. When they are in this state of excessive densit they are called *cirro-stratus* clouds. The cirro-stratus is characterized by it arrangement in long parallel lines of clouds in close proximity, straight or wavy and laying in horizontal strata. It is also often seen in a long and narrow hori zontal sheet, tapering towards each extremity. It is also called wane cloud from the fibres of the thin, fleecy cirrus cloud waning or subsiding into it. It prevalence indicates snow, rain or wind. In the form of rows of small clouds curved in a peculiar manner, it is called the cymoid cirro-stratus, and is a sur indication of a storm. If the sky appears spread over by a thin, hazy veil, par ticularly towards night, and obscuring the sun or moon, it is a certain sign o approaching rain or snow.

When the cirrus descends to a lower level, by becoming partially melted and its parallel bands breaking up into small and light transparent clouds o vesicular vapor, so transparent that the stars or the moon may be seen through them, it is called the *cirro-cumulus*. This kind of cloud may also appear inde pendently of the previous existence of cirri clouds. It floats at a high elevation but not so high as the cirrus. It is often seen by the light of the moon, through the scud and drift of the lower clouds tranquilly reposing in the heavens. When they receive abundant light they appear round and fleecy. When the sky i covered with them, it is said to be dappled. Their mean height is from 13,000 feet to 18,000 feet. Their appearance in summer is an indication of ho weather.

2. The Cumulus or staken cloud is the summer day cloud. It rises and aug ments during the morning. About sunrise it is seen to form by gathering th small specks of cloud, which are the scattered night mists, and which accumu lating into one mass resemble the appearance of distant hills covered with snow They are piled one upon another, their clear-cut edges tracing well-defined line upon the sky. Their form is generally rounded and dense. Their thickne varies from 13,000 to 17,000 feet, and their mean height is about 10,000 feet In calm weather they are obviously formed from the rising vapors. The augment as the heat increases, reach their greatest elevation and size as th heat is the greatest, from which time they decrease in size and elevation, an

ultimately disappear. Sometimes these rounded masses become heaped upon another and form the large accumulated cloud-mountains upon the hori

In summer the columns of irregularly ascending vapors, invisible below, brought into view above, as the watery particles reach the stratum of the atn phere already at the dew point. There the vapors, arrested in their asc form piles of clouds of hemispherical forms, the apparently flat bases of wl mark the level where hygrometric saturation commences. As the warmth of day increases, more vapor is carried aloft and these piles of clouds augmen size, density and height. They gradually obscure the rays of the sun, by wl they may be so dispersed, or may so cool the atmosphere, and condense cool winds into rain clouds, by which they return a refreshing moisture to earth. This passage of the cummulas into the rain cloud or nimbus, is ca the *cumulo-stratus*. A single cumulo-stratus is sometimes seen to swell ou the top, laterally, till it overhangs the base in irregularly-shaped protubera and dark masses. Sometimes the margins and protuberances, shining wi strong silvery or golden light, present a magnificent and imposing appeara This form of cloud is sometimes dispersed by evaporation or turned back to cumulus.

The *Nimbus* is the rain cloud. It is usually formed from the cum stratus, which grows darker until its dense blackness and angry aspect su indicates rain. As its blackness gives place to a gray obscurity, the rain and gradually the nimbus is replaced by the usual clouds of the sky.

3. The Stratus is the cloud of the night and winter, although not confi to that time. It generally forms at sunset and is dispersed at sunrise. class of clouds comprehends all those fogs and creeping mists that spread li mantle over the surface of the valleys, plains, lakes and rivers. It consist horizontal layers or bands near the surface of the earth.

The stratus is formed by the vapors of the atmosphere descending tow the surface. This form of cloud is sometimes suddenly produced, overspr ing the heavens in a few minutes by the temperature of the air falling radiation or by diminished atmospheric pressure. The stratus falls lower t any other cloud, creeping along the valleys and lying upon the surface of lakes and rivers. In winter it continues as an overhanging cloud for days time, shrouding the landscape like a gray and gloomy veil, hiding the face of sun, and decreasing the temperature by depriving the earth of the beams of heat-giving luminary.

The stratus can never be called an invigorating or cheering cloud, but always a depressing and desponding effect upon the minds of mankind, v many other clouds, by their bright colors and fantastic forms, have a che effect.

OCEANIC MOVEMENTS.

BY J. MANFORD KERR, TROY, OHIO.

MINOR MOVEMENTS — COMMON WAVES.

Amongst the inferior oceanic movements may be classed the different kinds of waves, and the various surface-currents.

Waves are of two classes or kinds, to-wit: (I) common waves, and (II) tidal waves. Common waves may be divided into the following sub-classes, to-wit: (1) ordinary waves, (2) storm waves, (3) earthquake waves, (4) surge waves, or *cavalloni*, and (5) ground-swells.

Common waves, as already stated, are the result of the action of the lower stratum of the superposed atmosphere upon the upper stratum of the water. The magnitude and velocity of these waves depend upon (1) the amount and length of duration of the force exerted—which is the *primum mobile*, (2) the depth and configuration of the oceanic basin, (3) the density and salinity of the water, (4) the exposure, and (5) opposing barriers—such as islands, submarine mountains, and all other objects which impede or retard the apparent onward-flow of the waves.

When free from atmospheric, solar-lunar, and subterranean influences, the waters of the ocean are perfectly calm and tranquil, mirroring all objects suspended above them or situated along the margin. It is very seldom, and within circumscribed areas, that this hiatus in oceanic movements occurs. During the prevalence of such a condition of the ocean, the solitary phenomenon that breaks the monotony is the mirage, which causes the oceanic horizon to appear like a vast band of polished silver or burnished steel.

The waters being extremely sensitive, the gentlest breath of air is not lost upon the susceptible surface of the ocean. The gentlest zephyr that fans the fevered brow of the faithful tar in the tropical regions, is sufficient to transfuse the aquatic mirror into a regularly-corrugated expanse. The magnitude, regularity, and speed of the waves thus raised are dependent on the force and regularity of the *primum mobile*, and the coadjuvancy of secondary or modifying causes. A gentle gale of unintermittant monotonous force, and which continues for a considerable length of time from a given direction, raises gently-oscillating billows of uniformity of magnitude and speed, which follow each other in regular succession, and at uniform intervals, and continue to roll their graceful curves across the watery expanse after the *primum mobile* has retired to the cave of Æolus.

But waves of such uniformity of altitude and regularity of succession can occur only in districts where the waters are subject to winds uniform in force and direction; for in those areas where the prevailing winds are unsteady in the force exerted during continuance, variable in length of continuance, and capricious in direction, the wave-movements are exceedingly variable. The axes of the waves

raised are invariably developed at right angles with the line of the directic which the moving force is exerted. We have already seen that the waves tinue to undulate after the *primum mobile* originating them has ceased. If forces producing different systems of undulations are exerted in different di tions, the progression-lines of the waves, as well as those of the parallelism of axes, will be different, and the waves produced by the second force may n themselves manifest before those of the first have ceased to undulate; in w case the two systems will conflict. A third force, operating in still another of direction, may propagate a third system of waves before the two prece have died away, which will produce a confusion of movements.

All this follows inevitably from the very nature of things.

The *primum mobile* is the movement of the atmosphere, which sustains relation of supercontiguity to the upper stratum of the water. The moven of the atmosphere is caused by a disturbance of aerial equilibrium. This turbance is occasioned by inequality in the density of the atmosphere. movement of the atmosphere to restore uniformity of density and re-estal equilibrium, produces a current of air of greater or less force in proportio the extent of the disturbance of the equilibrium—that is, in proportion to extent of the disparity of density. The currents thus formed are vario denominated, according to force and extent, breezes, gales and—when attain to the majority of their force—tempests.

The cause of difference of density in the strata of the atmosphere is h Becoming lighter as it is heated, air ascends, and the surrounding cold a which is denser than the heated air—rushes in to supply the place of the asc ing air, thereby causing a current. Now, the quantity of ascending air b proportionate to the intensity of the heat, consequently the disturbanc equilibrium is proportionate to the intensity of the heat producing said dist ance. Since the supply of cold air is always proportionate to the amou ascending air, and as the aerial current is produced by the movement of the rounding cold air to supply the place of the heated air, therefore the volu force, and duration of the current will be proportionate, directly, to the am of displacement occasioned by the ascending air, and, ultimately, to the in sity of heat.

Suppose that the atmosphere were perfectly calm, not a current of any k traversing it in any direction. Under this condition the equilibrium would absolutely perfect. But let a cloud pass beneath the sun, thereby intercep his rays. The column thus deprived of direct solar-radiation will be redu in temperature and condensed in volume and increased in density. This disturb the aerial equilibrium; to re-establish which the condensed air will place the adjoining air of greater rarity, and thereby produce a current.

Again, suppose that instead of a cloud passing beneath the sun, the were to remain stationary directly over our heads; the effect would be dire the reverse of the preceding, but the ultimate result would be the same—a

rent of air. The column of air would become heated and ascend. To supply the displacement occasioned by this ascension, the cooler and denser air from all quarters would rush in; and the current, instead of setting *outward*—as in the case first supposed—from a given point, would set *inward* to a given point.

When the displacement is but small, the quantity of cool air required to supply the deficiency and restore the equilibrium is small in proportion, and the current is accordingly gentle—producing what we denominate a breeze. The current is always proportionate in force to the amount of disturbance of equilibrium, and consequently varies in degree from the gentlest current of a summer's evening, to the most terrific tempest that lashes into foam the billows of ocean.

The altitude and speed of waves are subject to various modifying influences, which we have already enumerated. If the density and salinity of two bodies of water are the same, and the depth uniform, the one with the narrower channel will afford the smaller waves with a given *primum mobile*. Hence the waves of the Caspian Sea are far inferior to those of the Mediterranean Sea; while those of the Mediterranean Sea are inferior to those of the Northern Atlantic Ocean; and these in their turn are exceeded by those of the Antarctic Ocean—which sweeps, almost uninterruptedly, over a whole hemisphere.

Scoresby, the famous navigator, who sailed from Liverpool to Boston in 1847, found, by extensive observation and accurate measurement, made during this voyage, the general run of the waves of the Northern Atlantic to be from 26 to 29.5 feet. On his return voyage the next year, he found the general average to be 30 feet, with now and then an exceptional altitude of 43 feet. Other navigators and observers have announced confirmatory results.

In the vicinity of the Cape of Good Hope, where the basins of the Atlantic Ocean and Indian Ocean come together, it is no uncommon occurrence to see waves of an altitude of from 50 to 60 feet. M. d'Urville announces that he observed and measured waves exceeding 108 feet in altitude. The truth of this assertion is attested by the results of the measurements of M. d'Langle.

In the Mediterranean, tempest waves have a general run in altitude from 10 to 18 feet, with exceptional waves of rare occurrence of 30 feet vertical height.

The waves of the greatest altitude are not produced, as many have supposed, during the prevalence of furious tempests, but when the wind is high and very regular, continuing for a long time from a given point of space. During violent storms the force of the wind, which precipitates itself obliquely upon the water, breaks and crushes the waves.

The apparent rolling of the billows of the ocean is an optical illusion. What is apparently an onward-flow is simply a vertical oscillation. The waters of the ocean, sinking and rising under the pressure of the wind, cannot be properly said to advance. The only thing that is changed is the sparkling foam-crown which is precipitated from the crest of a wave adown the front declivity into the watery valley, is thence carried to the summit of the next, and so on *ad infinitum*.

The vertical depth to which wave-influence extends beneath the surfac the water, has long been a puzzling question for physicists. Formerly it supposed that this influence had a range of from 6 to 8 fathoms only; but now known that it extends to the depth of 100 fathoms.

The numerous experiments of Weber led him to lay down the follow formula for the ascertainment of the vertical depth to which the influenc waves extends, to-wit: the vertical depth to which wave influence extends i proportion to the altitude of the wave producing it as 350 to 1. Acc ing to this method of ascertainment, every wave of the North Sea of an altit of one foot, makes itself felt to the bottom of the basin—a distance of fathoms; and the influence of every oceanic billow of 33 feet altitude, exte to a depth of 1,925 fathoms, or 2⅛ miles. The formula laid down by Webe not susceptible of absolute demonstration, and the results obtained by its ap cation contravene the conclusions drawn from the observations and experim of other investigators; for these reasons it should not be relied on implicitl a well-ascertained principle in hydraulics of universal application.

The influence exerted at the enormous depth indicated by the applica of Weber's formula, if in reality it extends so far, is certainly so weak as t rather imaginary than real. Wave-influence diminishes in geometrical pro tion as it progresses downwards. However, the influence exerted at a dept from 25 to 50 fathoms is very great, and a multitude of waves abruptly arre by submerged rocks or marine table-lands, within that depth, produce vio eddies, heavy-surges, ground-swells and tide-races.

As the waves, raised in mid-ocean, approach rugged coasts of continent rocky islands, they become grandest and most formidable. They are known as "coast waves." And here, during the prevalence of violent sto the heavy-surge raises above the billows of ocean. The mid-ocean wave, approaches the shore, meets with greater and greater opposition from the gr ally-rising bottom of the basin, and is consequently greatly retarded. strata of water over which it progresses gradually diminishes in thickness, finally they are increased by water from the shore-approaching wave. increases the depth of the strata and thus diminishes the retarding force w the succeeding wave will meet, thereby enabling it to gain upon, and fi overtake, the one that preceded it, adding its own bulk to that of the first. doubled wave is in turn overtaken by wave number three, and reduplica This process is continued until "finally, near the strand, the liquid mass, swe by the pursuing waves, and unable to spread out further at its base along shore, which is too near, gains in height what it wants in breadth, and, ri like a wall, bends over with a wide curve in front, and breaks with thunde sound, throwing water, mixed with sand and foam, far along the shore."

To the ancients, whose fruitful fancy-working imagination anthropo phized the Deity and invested every phenomena and occurrence with im sonation, the foam-crested surge — the whiteness of which bears a di

resemblance to the fleece of a sheep—was known as the flocks of Proteus, the cowherd of Neptune; and the "coast waves," which are to-day called *cavalli* and *cavalloni* by the people of Southern Europe, were looked upon as the foaming steeds of Hippodromes, called by Homer the awful tamer of horses, and generally looked upon as the equestrian god.

Earthquake waves are the result of the disturbance of marine equilibrium by subterranean forces.

THE UPPER YOSEMITE FALL.—This magnificent waterfall is 1,550 feet high. It leaps clear from the rocks into the air and is soon torn into spray. "It seems," says Prof. Brewer, "as mobile as smoke, and assumed new varieties of outlines each instant, so light and airy that it seemed as easily swayed by the wind as lace; yet it struck with deafening thunder. The concussion was perceptible through the granite for some distance. The discharge of water is estimated at 250 to 300 cubic feet per second. In winter the water falls behind a great cone of ice, which is from 100 to 200 feet thick, and emerging beneath the ice, a grand and stupendous arch is formed like those in the glaciers at Mt. Blanc. Standing at the foot of this magnificent fall, a thousand feet above the bottom of the valley, the violent tempest of spray, ice pellets, or hail, are felt with great force, the hands and face being stung like shot by the pelting hail stones. These fell in great profusion, but rapidly melted, for the sun shone full on the fall and the adjoining rocks reflected the heat. The diameter of some of these pellets was 1-10 of an inch. Thus we have here the spray of a waterfall condensed and frozen into hail. The water of this stream, being supplied from the melting snows, plunges over the brink of the precipice just at the freezing point. In its fall it appears to be 'atomized' for 1,200 or 1,400 feet of its descent. A large volume of air is drawn into this falling mass along its whole course, the sheet spreading as it descends. The quantity of air is so great that it pushes outward on the bottom of the valley and is very perceptible as a cool current more than a mile distant from the base of the upper fall. The air as sucked into the fall is immediately cooled to 32° by the ice-cold water. As it passes in, it is very dry, and the rapid saturation within the sheet is sufficient to freeze a portion of the drops."

THE CRATER LAKE IN OREGON.—This celebrated natural curiosity is a large lake situated deep down in the bottom of an immense chasm, with perfectly perpendicular smooth walls. The lake has no shore or beach, the high volcanic walls of rock rising vertically out of the water. The lake is thirty miles in circumference; it has no outlet, and its surrounding walls are over 1,100 feet high, so that it is impossible to reach the surface of the water. It presents a scene of weird and wild magnificence, and is a place held in great religious reverence by the Indians. Whence this vast body of water comes, or where it empties itself, is a matter of mystery.

ARSENIC.

T. A. FELCH, M. D., TOLEDO, O.

The metallic arsenic is one of those metals which is rarely found in workshop of nature in a pure and free condition, but is almost invariably un with certain other metals, either in a chemical or in simply a mechanical c bination. It must consequently be liberated from such combination before can judge of its sensible or physical properties. The metal appears as a brittle substance of a steel-gray color—tasteless, and burning in the open with a bluish flame and emitting a garlic-like odor. In Europe, in some places, it is found by itself, but more often it is in connection with nickel, col iron, copper and sulphur. In some of the mineral waters traces of arsenic found. But the metal has a very limited application in the arts and scien and it is only in the various preparations as given by the chemist that we ju of its properties.

The most common form of the metal, as seen in the shops, is the w oxide, or, as it is more frequently called, the arsenious acid. This is obtai by roasting the ores containing the metal, the fumes arising from which condensed and collected in the proper apparatus, and afterward refined sublimation. It presents the appearance of a white, heavy powder, inodor of a slightly sweetish taste, fusible and wholly vaporizable by heat. As procured by the above process it is in beautiful transparent, glass-like mas which gradually become opaque through the absorption of minute particle water. Known from the earliest times as a highly dangerous and fatal poi it assumes importance in a medico-legal point of view. Many cases of in tional poisoning by arsenic have been reported, and it is now gratifying to k that the advancement of the art of chemistry has been such, that we are enal to detect the minutest traces of arsenic in the tissues, even after the lapse o indefinite period of time.

In medicine the application of the different preparations to the vari forms of disease is numerous, and the result often very gratifying. Perhaps malarial class of diseases are those over which it exerts its most beneficial effe and it is said that, in the vicinity of works where metals containing arsenic smelted, malarial diseases are unknown. In certain classes of skin diseases, example, almost specific properties may be ascribed to it.

Acute cases of arsenical poisoning are not of very frequent occurren though often fatal in their results. There is no known article which counteract the effects of the poison when once it has entered the circulat fluids. Therefore, besides the general means adapted to any case of ac poisoning by whatever agent, our antidotes must consist of such substances will, by combining chemically with the arsenic before its absorption, produce inert substance. There are two articles known to produce such an effect, v

the hydrated sesquioxide of iron and the freshly-precipitated hydrated magn esia. But, though all these means may have been faithfully tried, so virulent is the poison and so deep the impression made upon the system, that the case may still progress to a fatal termination.

There is another and more frequent form of poisoning by this article, called the slow arsenical poisoning, which occurs when the system becomes saturated with the agent: either by continuing its use as a medicine for an improper length of time, or its absorption through the skin by actual contact, or through the lungs by the inhalation of its fumes. Thus workmen engaged in the arsenical manufactories often present so strongly the symptoms of poisoning, that they are compelled to desist from such work until the symptoms disappear. Attention has within the last few years been called to a means by which slow arsenical poisoning occurs, more dangerous because more unknown and concealed. It is known that certain of the colors acquire by the addition of arsenic a brilliancy not otherwise obtained—notably so, the bright green formed by the addition of arsenite of copper. But green is not alone the dangerous color, for it may be so combined with others as to produce the various tints so much admired.

The beautiful aniline red, and possibly the other aniline colors, are not free from it in poisoning quantities. When applied as paint its poisonous effects are seldom experienced, on account of the varnish preventing the particles of matter from becoming detached. Spread, however, upon paper and covering the sides of nearly every room in the house, it must, and experience shows that it does exercise a very deleterious influence upon the health of the person occupying such rooms. Chemical analysis shows that much of this paper contains as high as 1.16 grains of arsenic to the square foot; that the dust collected in rooms where this paper is used contains very material quantities of the agent; in fact, that the air there is saturated with it. Considering the large extent of surface exposed in even a small room, it is evident that the poison will be absorbed in sufficient quantities to produce bad effects, and even death itself may attend its presence.

Ordinary wall-paper, such as is for sale by all dealers throughout the country, of a bright green, gray or mixed color, is not above suspicion, and should be examined for traces of arsenic before it is purchased.

The test is very simple and can be used by any ordinary person. As given by Dr. Kedzie, of Michigan, it is thus: On *green* arsenical paper pour a little ammonia water, and if it changes the green color, or produces such a change as indicates the removal of green, arsenic is probably present. To identify the presence of arsenic in *any* paper: Wet the paper with ammonia water; pour off this on a clean piece of glass and drop into this a small piece of lunar caustic. If a yellow precipitate forms around the crystal it indicates the presence of arsenic.

The symptoms of this slow poisoning are known to all physicians, and obviously the means of cure is simply the removal of the cause—that is, of the paper itself. Should one not wish to do this, then let the paper be covered by a

coating of transparent varnish which will confine the poison pigments to t places. It is much to be hoped that some effective means will be take prevent the sale of such poisonous papers.

The metallic arsenic is used in the manufacture of shot, it rendering the more brittle. The taxidermist finds the arsenious acid an excellent artic the preparation of his specimens. It is thus seen that such a powerful dangerous article as the compounds of arsenic should only be used with greatest caution and under competent advice. The practice of combini with articles in daily use—cloths, paper, paints, toys, candies and cosm should be understood by the people at large, that they may be on their g against such an insidious enemy.

As a matter of curiosity, and as illustrating the great immunity whi system may acquire from an ordinary poison, through its continued and cau use, may be mentioned the arsenic eaters of Styria, a province of Austria. habit of arsenic eating bears some analogy to the habit of opium eating. are deadly poisons, and both tend at last to bring the life of the individual sudden close, and the abrupt termination of the habit is attended with m sufferings and even fatal consequences. But here the analogy ends, for, w the effects of opium render the person unfit for the pleasures and duties of s and business life, the eating of arsenic is, it is claimed, attended with ce evident advantages. Its advocates claim that taken in reasonable quantit prevents illness, furthers their wish to look rosy and healthy; that it is a re against difficulty of breathing and assists the digestion of indigestible They commence with a dose of arsenious acid the size of a pin's head; th gradually increased until the enormous quantity of 14 grammes, 215 grains, be taken at once (Knapp)! The interval between the doses is exceed various—some indulging the habit by a moderate dose daily, others only a few days, and others again only at intervals of several weeks. The appear of these persons is always robust and healthy, in fact, only robust person become accustomed to its use. Many of them attain a remarkable old age, instances are known where the habit has been continued for a period of t than forty years! But, like the opium, the alcoholic, and the tobacco, ha arsenic eating is an acquired habit; and though it may not be followed b great depressing effects physically, or by that moral obliquity which somet attends the use of the former, its presence alone causes the suspension of ce natural laws and the substitution of others abnormal; and its use, as an ar of diet, should never, by any means, be encouraged.

The habit once formed can safely be left off only by a gradual dimin of the dose, and the experience of one undertaking such a task would prob equal or rival the miseries so graphically depicted by DeQuincey.

THE LIFE OF A MOSQUITO.

(*Culex Pipiens.*)

Embosomed in a shady, quiet nook, buried deep in the great and grand old forest, surrounded by the tall moss-covered trunks of oaks and elms, where, in autumn, blackberries cluster among the bushes, and, in spring, sweet buttercups line its margins with their soft, green leaves and yellow stars, and o'er which arching branches of the towering trees interlace and make a rustling, waving roof, under whose canopy many fire-flies dance, with their tiny lamps, like spectres in the dark, is a lake, and this pool is the home of many a curious creature—the scene of many a wondrous tale.

Few who gazed upon its quiet, tranquil bosom knew of the strange things that were happening in that little sheet of water; so still and quiet did the calm waters look, hemmed in by the tall rushes and willow trees that bent over it as if looking at their own reflections, deep down in the slumbering waters below.

It was a favorite spot for the poet and the artist. Here they loved to sit and gaze at its tranquil bosom, reflecting the fleecy clouds as they passed overhead. Many an artist has tried to transfer that quiet sheet of water, with its wondrous reflections of sky and cloud, tree and bush, stones and rushes, and turned away with a sigh at the impossibility of rendering correctly those mysteries of light and shade, those subdued and broken tints which throw such a magic glamour o'er this sylvan scene. Yet many of these devotees at the shrine of Beauty were ignorant of the secrets hid in the depths of the bosom of this pool. It was, indeed, a fit home for the many forest-nymphs,—the beauteous dragon flies which dart along its surface, the gay and brilliantly-painted butterflies who hover daintily about its edges, sipping the nectar from the numerous colored flower-cups upon its mossy banks.

Yet, tranquil and quiet as was this lonely sylvan pool, buried in its green forest grove, great events daily took place in that little pond, whose depths and surface teemed with life—silent, mysterious busy life.

Water-spiders were busy in their various occupations, constructing their silken diving-bells; tadpoles were finding their legs and losing their tails; the lively little water-beetles were darting here and there, over the surface of the pond, and the great problem of life was being enacted in its midst;—the strong were preying upon the weak; life and death were going on there; and multitudes of creatures, whose very names are unknown, were passing through their short careers, enacting scenes and tragedies of thrilling interest;—in fact, a strange, magic world is here disclosed. Among all this strange, varied, teeming life, a delicate little boat is seen floating upon the tiny wavelets. A very small boat it is; yet one that bears as many lives in it as did ever any boat built by man. This is an egg-boat; not an empty egg-shell; but one freighted with precious, living burdens,—a fairy-like craft, dancing lightly upon the glistening waves. This little egg-boat, composed of from two to three hundred eggs, any one of

which alone would be heavy enough to sink the little craft, is put togeth
such a wondrous and skillful way that the whole mass floats buoyantly upo
surface, and even if pushed underneath, reappears again, right side up and
out being wet. This boat is shaped high at the bow and stern, and moves sl
and steadily upon an even keel. Thus composed of hundreds of eggs,
one destined to liberate a living being, after which the empty shell, their fo
home, will float at the mercy of the waves, finally to be wrecked or cast
the shores, a useless hulk. Such, then, is the birth-place of our little
Born a sailor, he is destined eventually to become an inhabitant of that eth
ocean which surrounds and envelopes the earth—the atmosphere.

Each egg composing this tiny craft is shaped like a club, the larger
placed downwards, and all joined nicely to each other at the middle of
lengths. Through the lower ends the future insect escapes.

As each tiny passenger escapes from its fairy little craft that has borne
so lightly and safely over the waters, they do not by any means take to dry l
but are at once able to swim, dive and disport themselves in the water, wit
the aid of a boat; for from every egg has escaped a being able to live in
water as a true nautilus. As each tiny sailor slips out of its little state-ro
one of the cells of this bark, it is at once endowed by nature with the powe
provide for itself and lead an independent existence.

As the little creature escapes from the shell, it plunges head-foremost
the water, where it disports at its will. When tired of whirling about on
surface, it closes a valve affixed to its tail, and sinks to the bottom; when, a
it wishes to rise, it unfurls its hairy, star-like valve, in which is inclosed a glo
of air, and quickly ascends to the surface. These little animals breathe thr
their tail, which is furnished with a tube, around the outer end of which
bunch of hair, arranged like a star, which is oily and impervious to w
When he wishes to descend, the little water-nymph closes this tube in the
and folds the encircling hairs around it, enclosing a bubble of air, and sink
the bottom; then, when he wishes to ascend, he unfurls his hairy star, and
globule of air carries him to the top again.

So passes several days—swimming about in the water or diving to its de
But gradually a change comes over the little creature,—he begins to turn
head upward, instead of downward, and behind it sprout two branching
which serve as lungs; for he no longer breathes through the funnel-shaped
which has also changed, the funnel having disappeared, and in its place a fi
broad and flat extremity has appeared, which enables him to swim rapidly a
as his fancy directs; but he soon loses all desire to swim. The air, whic
late has been all his food, has become dearer to him; he lifts his head hi
above the water, until finally he bursts the shell or outer skin that enve
his body, and, drawing his head and shoulders out of it, finally he escapes f
his old skin through this rent, and rises out of the water, which so long has
his home, into a new world, a wondrous existence, a new life, from that
sailor floating in his boat upon the waves, a diver and a water-nymph dispor

as an independent existence on the water, to the life of a fairy being of the air But this wonderful transformation is not accomplished suddenly and at once Slowly and with great caution does the little creature disentangle himself fron the wreck of his old self, which now serves as a frail raft, and to which his nov upright body serves as a mast, wafting the old skin—which floats upon the wate as a tiny canoe, in which the new creature now stands upright—over the water as it listeth. Thus he stands, hesitating as if loth to leave his birth-place, th water which surrounds him and has been his home so long, or if doubtful o his new-born powers, and afraid to trust himself in the new element in which h is in future to find his home. In this position he remains until he has becom somewhat accustomed to the change of element, and has learned to balanc himself in the tiny bark; but now cautiously he draws out first one, then anothe long leg, and gently puts it down, until they touch the water. A pair of wing are then slowly drawn out,—at first damp and limp, drooping heavily down until the sun dries them, and they spread out, stiff and gauze-like, glistenin like jewels in the sun-light, the new-born and now-perfect insect, freed from it imprisonment, poises itself for a moment on the surface of the water, then, wit a shrill hum of joy at its freedom, the first sound it has ever uttered, it flie upward with the warm sunshine, a liberated, perfect being, inaugurating a free new life—a being of the air. How different from its former life, how differen from its former self, is this new creature! So light, so delicate, as it move through the air on its free, buoyant wings,—a handsome creature he is, with hi large bright eyes, and beautiful dancing plumes upon his head,—filled wit delight at its escape into this new, strange world of warmth and sun-light, th gnat dances gaily in the sun-shine, tired of solitude, for he is a social creature He immediately joins a company of his kindred engaged in a merry, bewilder ing, mazy dance, floating up and down, crossing and recrossing, in the brigh sun-light. How different from his life in the depths of the waters of the pool

We have thus followed the career of this little creature, from its birth an life in the pool, to its existence as a being of the air. Let us now examine it structure more thoroughly. The female gnat—who alone has the power to bit or suck blood, the males living entirely upon the nectar of flowers—fixes hersel to some object upon the surface of the water by the four anterior legs, crosse her hind legs, bringing them close to the end of the body, on a level with th water. The first egg is received and retained in place by the crossed legs. A the eggs are ejected, they are placed side by side, vertically, adhering firml together by a glutinous substance which covers them. When the stern of th craft is finished, it is pushed out from the mother into the water, always retaine in its place by the legs on the sides. When the boat's shape is determined, th legs are uncrossed and placed parallel, and the prow is formed. The larva come out of the eggs in a few days, from the lower end of the eggs. Thes larvæ are small creatures. They remain suspended head downwards, breathin air by means of a respiratory tube, that is attached at an angle from near th end of the body, communicating with the tracheæ. The tube and the termina

joint are provided with hairs, which radiate around its end. The head is ro furnished with antennæ and cilated organs, which keep up a constant cu of water towards the mouth, and bring the minute animaculæ on which feed, within their reach. The thorax and 10-jointed abdomen are furni with lateral pencils of hair. After living in this larvæ state from 5 to 15 according to the weather, they change their skins two or three times. The changed into pupœ, rolling over and over by means of the fin-like paddl the end of the tail, and swimming with the head upward. The respir organs are now at the end of two tubes, just behind the head, so that remain near the surface, head upwards. They remain in this state 5 or 10 It takes no food, and the future gnat can be seen through the transparent of the pupa. When the gnat is ready to escape from this pupa state, sunny day about noon, the pupa shell bursts down the back, the head appears, then the thorax, and finally the whole insect raises itself upon its and stands erect in its pupa-shell boat. This is now a very critical momen the slightest breeze would upset the tiny bark, and drown its occupant.

The perfect insect has a soft, elongated body, long legs, large round and eyes, long, many-jointed antennæ, feathered in the males. Filiform hairy palpi longest in the males. Membraneous wings, provided with bala A sucking probocis, consisting of a sheath enclosing two to six sharp bri or lancets. Winglets consisting of two small scales, moving with the w The gnat is said to vibrate its wings fifty times in a second. As their egg developed in less than three weeks into the perfect insect, they have se broods in a season. Many perish in extracting themselves from the pupa others serve as food for bats, birds, and insects.

The celebrated giant trees of California (*Sequoia Gigantea*) belong e sively to the coast region, nowhere extending more than 30 miles inland, not beyond 42° north latitude. One measured lately was 450 feet long trunk 52 feet in circumference is not rare. The bark of these trees is red brown, coarse and thick. The wood is easily cut; it resembles red cedar, not quite so even a grain. The bark is about 18 inches thick, stringy elastic in substance.

HEAT.—Combustion is not the only way that heat is produced. It is tained by most forms of chemical action. Friction also is a method by w heat is produced; and electricity is another prolific source of heat. The source of heat as well as light and chemical action on the earth is the but we receive some from the stars, which are distant suns, and some of t very large ones, although at such immense distances that they appear as specks of light upon the firmament. Herschel estimated that the star Lyra 54,000 times larger than our sun. Indeed, so distant are some of these imm suns that light, traveling 188,000 miles a second, takes over three thou years in reaching us. Yet light travels so rapidly that it passes around earth *eight times in a second.*

NUX VOMICA AND STRYCHNIA.

There is a tree growing on many islands of the Indian Archipelago, Bengal, Coromandel Coast, Ceylon and Cochin China, which has a world-wide reputation, both on account of its poisonous qualities, and its wide-spread employment as a remedial agent. This is the Strychnos Nux Vomica, a tree from which is obtained the button-shaped seeds known as Nux Vomica, and from which are prepared the active principles, Strychnia and Brucia.

The action of Nux Vomica has long been known in India, and the Arabian physicians are said to have been acquainted with its properties. It is comparatively but a few years since it has been extensively used in the practice of medicine, and the discovery of the alkaloid, Strychnia, was made as recently as the beginning of this century.

The tree, Strychnos Nux Vomica, is of moderate size, its branches are numerous and strong, and covered with a smooth, gray bark. The leaves are thick and of a shining dark green color. The flowers are small, and greenish white, and arranged in terminal corymbs. The fruit is a round or ovoid berry, about the size of an orange, and about the same color. The rind, which is hard, is filled with a pulpy mass, in which the seeds are embedded.

This seed is the portion which is chosen for medicinal purposes, and is known as the "dog button" among the people. It is about three-quarters to an inch in diameter, and about two lines in thickness. It is concave on one side and convex on the other, and therefore has much the appearance of a button. It is of a greenish gray color, and covered with silky hairs. It is very hard, both externally and internally, and is therefore pulverized with difficulty. The seeds are destitute of odor, but are of an extremely persistent bitter taste.

Strychnia and Brucia, two of the most important active principles, were discovered by Pelletier and Caventore, about the year 1818. The former alkaloid exists in a much greater quantity in the bean of St. Ignatius, than in the Nux Vomica seed, from which it derives its name.

By a complex pharmaceutical process, the Strychnia is separated from the crude drug, and about one-half of one per cent., or a little more than four-tenths of a grain is obtained from one hundred of the powdered bean or seed.

Strychnia is one of the most active of the vegetable poisons. "The experiments of Marcet prove that a solution of five grains of the extract of Nux Vomica in an ounce of water, caused a plant (*Phascolus vulgaris*) to die within twelve hours. Bouchardat found that water containing 1-1200th part of the Muriate of Strychnia or Brucia, was sufficient to kill a plant in five days."—(*Stille Materia Medica*)

It acts poisonously on all animals, but some seem to be more susceptible than others to its influence. Murray says: "If given to dogs, they pant in breathing, seem alarmed, and if forced to rise, their limbs are rigid. Tetanic spasms ensue, and, with short intermissions, recur until death. During the

spasm, according to these early experimenters, the animals appear to be inse ble to all impressions, so that even their ears or tails may be cut off, wit eliciting signs of pain."

All investigators agree that the phenomena following the introductio the poison into the system are about the same, consisting of tetanic convul from one to ten minutes in duration, with intervals of entire freedom therefr These paroxisms gradually become more frequent until death occurs from t spasm of the muscles of respiration.

On man, the action of the alkaloid, in medicinal doses, is of a purely t character, increasing the appetite and stimulating the nerves proceeding f the spinal column. It is very extensively employed by the profession, bei remedy of known value.

In poisonous doses, it acts very rapidly and induces all the phenom connected with convulsive action. The smallest quantity of Nux Vomica w is known to have caused death is said to have been three grains of the alcoh extract. Of strychnia, the least dose which is recorded as having proved to an adult appears to be half a grain. But one-sixteenth of a grain of stryc has destroyed the life of a child, between two and three years of age, in hours. Three or four grains have, however, been taken without fatal result (*Stille.*)

From experiments made, observers have concluded that lard or fat will vent the poisonous action of strychnia, if taken immediately after the introd tion of the poison into the stomach. Dr. Hammond demonstrated in one periment, that a dog to which the fat had been administered, died, whilst one to which the same dose of the poison had been given without such dition, lived. If an emetic can be given soon enough after the strychnia been swallowed, good results may be obtained. Dr. Woakes has shown aconite, given in proper doses, neutralizes the action of strychnia.

More recently, chloroform, given to complete ænesthesia, has operated as antidote; but it must be confessed that, all the proceedings that are in tuted for the purpose of antidoting the effects of this poison are untrustwor and failure is apt to follow for the reason of the rapidity with which the sy becomes completely under the influence of the poison. An emetic canno given soon enough, or the presence of a physician obtained before a fatal r has occurred; however, if the stomach can be emptied before absorption taken place, recovery may be expected.

This poison is seldom employed for suicidal purposes, but death has quently occurred by Strychnia being taken by mistake for Quinine, the app ance and taste of both alkaloids being sufficiently similar to deceive t who are not particularly acquainted with the peculiarities of each.

W. C. (

CENTRAL HEAT.—Abundant proof has been collected by scientific men in all parts of the world to prove that there is a steady increase of temperature encountered with increased depth below the surface. The volcanic fires, hot springs and earthquakes seem incontestably to add their testimony to the existence of intensely heated masses beneath the crust of the earth. The rate of increase in temperature is somewhat different in different countries, but the average is one degree for every 37 English feet. These phenomena, all pointing in one direction, have led to the conclusion that the center of the earth is intensely hot—that the most fierce fires must rage in the interior. But many objections have arose to this theory, among them one that if the center were a melted, boiling, fiery mass, the crust could not exist, for if lava is boiling, the crust that forms when cooling soon melts. Were the crust of the globe the result of partial cooling from a state of primitive fluidity, the whole planet must first have cooled down to about the temperature of incipient fusion, and hence the enormous degree of heat supposed cannot exist within it. Were the central portion fluids, tides would be perceived in the mass sufficient to cause the surface to rise and fall every six hours, but no such fluctuations are observed even in volcanoes, which are supposed to be connected with the internal fires. Many suppose the rise of temperature to be occasioned by chemical changes taking place beneath the surface in local situations. These give rise to electrical currents of power sufficient to produce the phenomena witnessed on the surface, and that the local chemical changes are enough to account for the volcanic activity manifest. But, although this accounts for some of the phenomena, it is insufficient to answer all the difficulties, and the subject is yet largely speculative.

A cave has recently been discovered in Marion county, Mo., which promises to rival all others in extent and beauty. Large chambers and long and vaulted galleries succeed each other, their height varying from 30 to 100 feet. The dropping water has formed the most beautiful stalactites, and the ceiling is studded with decorations of groups of spar in a variety of figures, some resembling stars glistening in the dark roof above. Others resemble crystal pendants of a great variety of shades and sizes. A pistol fired in one of these vast subterranean caverns wakes echoes that reverberate for a long time, causing a deafening noise. This cave is called the Big Saltpetre Cave. In one place a transparent sheet of limestone extends from ceiling to floor like a curtain. In another apartment is a subterraneous river that flows through the cave. In still another room is a bottomless pit, whose interior has never been explored. In fact, the wonders of this cave seem never to end.

RECUPERATION OF SOLAR HEAT.

BY J. MANFORD KERR, TROY, O.

Every solar ray is a bundle of powerful forces—light, heat, actinism, electricity—which are potent energies comprehending, in their combined ac the conditions requisite for all the varieties of vegetable and animal org zations, and creating out of a chaotic mass "forms of beauty rejoicing in l According to Hunt, light is the luminous life-maintaining energy, giving to all things; heat, the calorific power which determines the condition o terrestrial matter; actinism, peculiarly the force which produces all photogra phenomena; electricity, that supremely potent power which regulates the netic condition of the earth.

Sunshine is absolutely indispensable to a healthy and luxuriant veget growth. A plant may be forced to grow in a place from which the light is cluded, but it will be a very puny and colorless growth—there will b deposition of woody fibre. In sunshine it glows with color, and revels luxuriant growth; its energies excited, it voraciously inhales the autochth carbonic acid of the atmosphere, as well as that given off by respiring anim and converts its carbon into ligneous structure, while the oxygen is returne promote the healthful condition of the atmosphere.

Every ray of light is a force produced by the mutation of a proporti amount of matter, and being charged with the potential energies of organi powers, when it comes in contact with terrestrial matter which possesses function of living, the production of a quantity of wood is the result. wood is an equivalent for the amount of matter which has changed form in sun. That is, the combined operation of light, heat, actinism, and electr has produced a certain quantity of wood in which these energies have absorbed—used up. Every cube of wood is the exponent of a certain am of sunshine (light and heat), and that sunshine is an exponent of the matter has changed form on a globe ninety-five millions of miles from us. The bustion of this cube of wood, as experience demonstrates, produces a ce amount of light and heat; and that actinism and electricity are also prese proven by a little examination. These energies are constant quantities. A nite amount of matter is changed to produce the sunshine requisite for the duction of a cube of wood; and philosophy teaches that the powers set when this cube is ignited are exactly those required for its growth.

When the shadow which overhung the terminal portion of the Devo æon, like a war-cloud over a vanquished and expiring hero, was dispell resuscitating gleam of sunshine exulted over the uprising continent, and clo it with an umbrageous foliage of tropical luxuriance. Ere yet the Great I the mighty Mississippi, or the thunder-voiced Niagara, over which Natur suspended her eternal iridescence, were to be enumerated among the things

were; ere yet any land animals had traversed this terraqueous sphere, the voice of bird broke the dread primeval silence, or the hum of insects wafted upon the murky atmosphere—while all these slept within "the chambers of futurity," and man existed only in the shadowy realm of ideas, patiently awaiting the fiat of the All-creating, the land was embellished with a lean vegetation, which derived its sustenance from the crude aliments of the rocky detritus, scattered here and there over the bleak, inhospitable exposures of the non-nutritious rocks.

The portentous cloud of dark, distended *nimbus* sets on the horizon round a settled gloom; vividly-darting and angular flames shoot with rapid radiance across the ebon concave, and the deep-toned thunder,

"Growling low with impatience."

convulses the world, and shakes o'er the tepid ocean prelusive drops.

Succeeding a perfect calm reigns throughout Nature.

"'Tis silence all, and pleasing expectation."

The over-burdened clouds let flow their moistening treasure, and Nature responds in cachinnations boisterous. Impetuous, the winds and waters flowed in according consonance. Wide dash the billowy waves in undulations vast, abrading the surf-beaten coast; and the incessant precipitation of the vernal shower, pulverized the bleak crests of the sun-scorched rocks, keeping up an inland abrasion, and thereby materially aiding in the preparation of a soil. On this soil gigantic forests of trees and shrubs everywhere sprang up simultaneously, from the great store-house of germless existence, in compliance with the edict of the Great Architect. This is the opening scene of a geological period, the prevailing characteristic of which was its luxuriant forests. These forests were successively destroyed by periodically-recurring catastrophes, during which the land and ocean heaved and sank, as if in the throes of mortal agony, completely inhuming these dense forests of gigantic coniferæ.

The length of time required to complete this geological period, is absolutely incomprehensible. "The amount of vegetable matter in a single coal seam, six inches thick, is greater than the most luxuriant growth of the present day would furnish in twelve hundred years." To form a series of coal-measures, of the aggregate thickness of sixty feet, would require 144,000 years; add to this the time occupied during the inundations, in the formation of shale, sandstone and limestone, and you will have at least double the above, or 288,000 years.

During the whole of the lapse of the enormous period required for the growth of the amount of vegetable matter sufficient to form the enormous deposition of coal with which the continents are blessed, the sun poured forth his light, heat, actinism, and electricity, to fructify the newly-formed soil of the youthful earth. The growth of this vegetation required a corresponding mutation of the matter of the sun. How vast then must have been the power originally residing in the sun, since the earth receives only $\frac{1}{2800}$ millionths of the whole amount emitted from that orb! The amount of heat precipitated upon a space ten yards square, "is sufficient to drive a nine horse power." Mayer has

estimated that the amount of heat radiated from the sun in one minute of t is twelve thousand, six hundred and fifty millions of "cubic miles of he Now a cubic mile of heat is the "amount of heat which is required to rai cubic mile of water one degree centigrade," which is about one and four-f degree Fahrenheit. A cubic mile of heat contains four hundred and eight lions of units of heat; a unit of heat is the "quantity of heat required to r one kilogramme—or about one quart of water one centigrade degree Res ing the sun's emitment of heat, Winchell says: "The sun emits more than septillions, or five thousand millions of millions of units of heat every min In a year the amount is 522,000 times as great; and in the brief duration of race, it has been more than three thousand million septillions of units of he Such an enormous expenditure of heat is sufficient to reduce the tempera of the sun two and one-fifth degrees annually. During the human perio 6,000 years, the temperature would have been reduced more than 13,000 deg

The sun's rays are the ultimate source of almost all motions, animate or animate, which take place upon the earth. "By their vivifying action veg bles are enabled to draw support from inorganic matter; and become, in t turn, the support of animals and man, and the source of those great deposit dynamical efficiency, which are laid up for human use in our coal strata."

It is a well-known fact that every incandescent and self-luminous bo decreases in temperature and luminosity, in proportion to the amount of l and heat radiated; and, unless in some manner recuperated, will eventually come perfectly cold and non-luminous. What, then, is the earth to bec frozen, the sun's bright light to be extinguished, and the moon and star "wander darkling in the eternal space"? This is the vaticinated end evol by the predictive laws of the universe, and the voice of Nature. But the cuperation of solar heat will protract this dying existence—will continue, constant and gradual diminution, the present order of existence, until the suscitative powers of the universe shall have been exhausted.

What are the sources from whence solar recuperation is derived? either of chemical or mechanical origin.

It is a universal law of nature, to which there is no exception, that in or that heat may be obtained, there must be something expended; this someth may be material expended in a chemical process, or some sort of a mechan operation.

When substances endowed with considerable chemical affinity for e other combined chemically, the development of quite an amount of heat d the process is the result. It has been established by numerous experime that in combusting, charcoal furnishes 2,700 deg., C., of heat; superior c 6,000 deg.: perfectly dry wood, 3,300 to 3,900 deg.; sulphur, 2,700 deg.: hydrogen, 34,600 deg. of heat.

In this combustion the number of units of heat depends upon the amo of matter consumed, and the same amount of heat is generated, whether combustion proceeds slowly or rapidly.

The same law obtains in the production of heat by mechanical means. The number of units of heat produced, depends upon the amount of physical power consumed, and not upon the manner in which said power is expended.

Is solar recuperation of chemical origin?

If solar heat is the production of chemical action, combustion is the process most efficient in its production. Under the most favorable assumption—assuming the sun to be an enormous mass of coal, comprehending within itself the elements of combustion, said combustion would suffice to replenish the solar universe with its energizing and vivifying influence for a comparatively short space of time. As Sir William Thomson has remarked, it is highly probable that a body "might, for a time, be as large as the sun and give out luminous heat as copiously, to be freely radiated into space, without suffering more absorption from its atmosphere of gaseous products than the light of the sun actually does experience from the dense atmosphere through which it passes. Let us, therefore, consider at what rate such a body, giving out heat so copiously, would burn away; the heat of combustion could probably not be so much as 4,000 thermal units per pound of matter burned, the greatest thermal equivalent of chemical action yet ascertained falling considerably short of this. But 2,781 thermal units . . . . . are emitted per second for each square foot of the sun; hence there would be a loss of about 0.7 of a pound of matter per square foot per second, ... or a layer half a foot thick in a minute, or 55 miles thick in a year. At the same rate continued, a mass as large as the sun is at present would burn away in 8,000 years. If the sun has been burning at that rate in past time he must have been of double diameter, of quadruple heating power, and of eight-fold mass only 8,000 years ago." We may, therefore, very safely conclude that chemical action is not the source from whence solar recuperation is derived, and must consequently search in the mechanical process for the sun's fuel.

It was formerly thought that the sun's rays were devoid of all heat, and that they simply operated upon what was denominated the "substance" of heat—an element, it was assumed, all bodies possessed—in such a manner as to set this "substance," which was at rest, in motion, thereby producing the phenomena of heat. It has been clearly and incontrovertably ascertained that the sun's rays are not simply a radiation of cold phosphorescent light, but possessed of a calorific intensity capable of being accurately ascertained; to ascribe such rays to a gelid orb is at variance with reason and experience.

It has been suggested this generation of recuperative heat is the result of friction. If this be true, where is nature's rublock—where the opposing obstacle—where the chafing body? Even if the presence of such a body could be detected, it has been shown, by a calculation based upon the sun's mass and rate of rotation, that the heat thus generated would only be sufficient to supply solar expenditure for 183 years. Hence we see that upon a close examination the theory becomes untenable.

The only plausible, tenable theory of solar recuperation is the one kno as the "meteoric" theory. According to this theory the solar expenditur replenished by the heat generated by the impact and ricochet of planetary a cometary bodies, and meteorites and particles of cosmical dust. All these w dering celestial bodies may be said to have their cradle on the periphery of t solar system, and their common grave at its centre. They are all circling rou the sun in a flowing stream of rapid radiance, and forever approaching nea and nearer to the sun, until they are gradually drawn into the solar fires, a then plunge with violent impetus into their common grave. But the supply these celestials is not infinite—is not exhaustless. After the lapse of a co paratively short time all these celestials wandering within the orbit of Nept will be precipitated to the surface of the sun. What then will be the fate the latter?

The processes which are now making progress in the universe unmistak predict the ultimate total extinction of the solar fire. The vivid light and ch ing heat which at present, permeating, vivifies and fructifies the solar sys will wan gradually until the complete extinction of the fires of that benefic orb which has so long dispensed animation throughout the solar universe. stream of life will gently ebb away—will gradually run lower and lower; the total annihilation of all animate existence will be followed by the in precipitation of the planets, together with their numerous satellites, to the sou from whence they derived their existence.

AIR.

Air is the absolute necessity of every living thing, from the most mi animalculæ to the gigantic elephant that crushes through the jungles of Af from the tiny stem of moss to the towering monarch of the forest that lift head proudly above the woods. It is the very first element of our bodily sures, and breathing affords fully three-quarters of the nourishment of bodies; while again, the other quarter, which is obtained from the solid fluid aliment, is also in great part composed of oxygen, nitrogen and carbo acid—the elements of the atmosphere.

Chemically, the air consists of a mixture of two kinds of gases, oxyge *vital* air, and nitrogen, in proportion by volume of 1-5 of the former to 4 the latter, and besides these two gases, carbonic acid, or *fixed* air, whic ists in the free atmosphere in the proportion of about four parts to ten thou

In this small proportion in which carbonic acid exists in the free atmosphere it produces no evil effects, but in larger portions it produces dan ous and frequently fatal effects. Being heavier than the other atmospheric it is usually formed near the surface of the earth, especially in mines, caves wells.

Pure oxygen will sustain life for a short time only. On account o stimulating qualities, it requires dilution, which seems to be the office of nitr

which, alone, cannot sustain life at all, and by itself is a deadly and fatal poison. Carbonic acid, when pure, is not respirable, the glottis closes and will not permit its introduction into the lungs when an attempt is made to inhale it. But when diluted with twice as much, or more, of pure air, it ceases to produce that effect upon the glottis, and is allowed free access to the lungs and produces very dangerous effects.

The average amount of oxygen consumed by a healthy person is half a cubic inch to every respiration, which, in a day, amounts to upwards of 25 cubic feet; and as oxygen consists of but one-fifth of the volume of atmospheric air, a single individual renders 125 cubic feet of air unfit for respiration every twenty-four hours by the abstraction of oxygen alone. At the same time there is exhaled from the lungs about 15 cubic feet of carbonic acid, 30 ounces of watery vapor, and an indefinite amount of organic matter estimated at from 10 to 240 grains. The whole quantity of air respired in twenty-four hours by a healthy person is about 400 cubic feet.

The late expedition sent to explore the Yellowstone region, in the north-west corner of Wyoming Territory, found, at the highest point of the mountain passes of the National Park, a stream of water, which was very appropriately named "Two-Ocean Water." This stream flows down into a little valley, where it splits into two rivulets, one of which, flowing west, falls into a tributary of the Snake and Columbia Rivers, and thus finds its way into the Pacific Ocean; and the other, through the Yellowstone and Missouri, discharges its waters into the Gulf of Mexico.

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BLADE PRINTING & PAPER COMPANY.

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VOL. I. No. 8.

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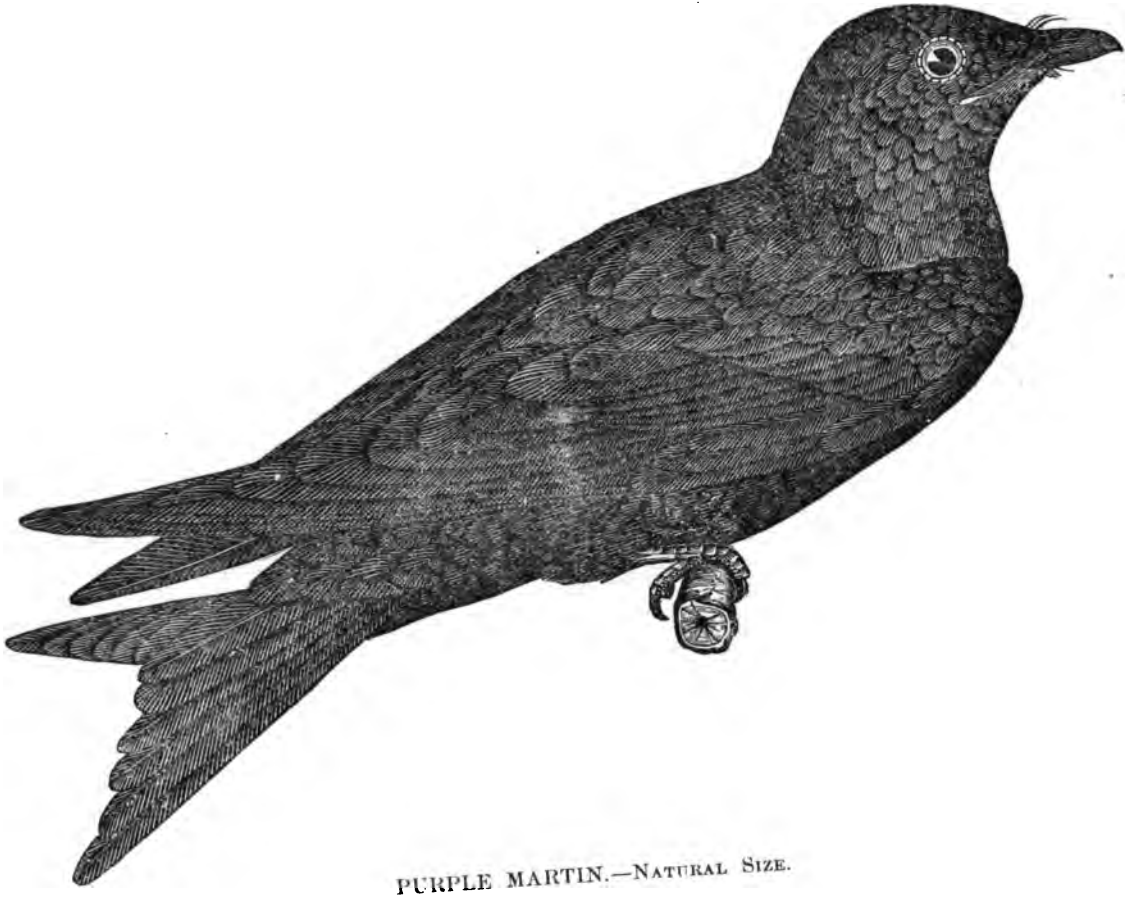


PURPLE MARTIN.—Natural Size.

The Scientific Monthly

DEVOTED TO THE NATURAL SCIENCES.

VOL. I. MAY, 1876. NO

OCEANIC MOVEMENTS.

BY J. MANFORD KERR.

MINOR MOVEMENTS—*(Continued.)*—TIDAL WAVES.

The regular alternate rising and falling of the waters of the ocean t each day have attracted the attention of ocean coast-dwelling nations i ages of the world. Those nations which dwelt inland, or on the borde bodies of water so limited in extent that the tidal influence was scarcely ceptible, were not acquainted with these phenomena in all the phases of t manifestations. The Mediterranean Sea being of that class, of such lim magnitude as to preclude the possibility of the manifestation of a variet tidal phenomena, the Greeks and Romans did not enjoy the opportunit observing them in all their magnificence; but that they were acquainted their *existence* is manifest, for Herodotus, Pliny, Plutarch, Cæsar, and otl speak of them.

At an early date the tide-phenomena were attributed to planetary influe Plutarch informs us that Pytheas, a native of Massilia—who is generally posed to have flourished during the reign of Ptolemy Philadelphus, but is pl by Bougainville anterior to Aristotle, and was the first geographical writ whom we have any account, who brought astronomical knowledge to his a ascribed the tide-phenomena, which he observed at Britinnia during a nortl voyage, to the influence of the moon. Pliny attributes these phenomena to sun and moon "dragging the water after them." Cæsar, in his *Commenta* says that spring-tides and neap-tides were in his time known to be regulate their appearance by the moon. Kepler, ignorant of the law of gravitat

although evidently familiar with the principle upon which it rests, says that all bodies attract each other, and that the waters of the ocean would all pass to the moon if it were not for the resistance interposed by the attraction of the earth. This was the first enunciation of the theory which is to-day, with various modifications and improvements, accepted as the most plausible that has been offered. Galileo rejected these views. Discartes inverted the line of direction of the operating force and made the tide-phenomena the result, not of the attraction, but of the *pressure* of the sun's influence upon the water.

Newton, following the line Kepler had already indicated, gave the first substantial development to the present-prevailing gravitation theory. He regarded the phenomena of the fluctuations of the waters as the most incontrovertible proof afforded by the elements of the correctness of his generalizations which led to the announcement of the law of gravitation.

This theory, as put forth by Newton, has been since more fully developed by Bernouvilli, Euler, and Laplace, and materially modified by Lubback Whewell, and Chazallon; but is by no means satisfactory yet—it is simply the best afforded; many of the secondary influencing causes are yet awaiting elucidation, and most of the local phenomena are to be studied and understood. But we must bear in mind that it is only from the beginning of the present century that the theory of tides has made any material progress. To be able to follow the tides in their progress and fluctuations across the seas, it is not sufficient to know the laws of gravitation, and to calculate with the most rigorous exactitude the movements and position of the heavenly bodies; one must also know all the facts relative to the movements of fluids, and know how to apply all their phenomena of acceleration, retardation, increase, interference, and equilibrium, the most complicated and most minute formulæ of high mathematics. It is also very essential, actually indispensable, to be intimately acquainted with the configuration of the shores and the inequalities of the bottom of the oceanic basin.

The common explanation of the tidal phenomena—the gravitation theory—is very lucid and comprehensible. According to this doctrine every particle of matter in the whole material universe attracts every other particle—inversely as the square of the intervening distance, and proportionately to the *summa summarum* of matter in the two bodies. Hence the sun and moon not only attract each other and the earth, but every planet, visible or invisible, in the sidereal heavens. Because of its nearer proximity to the earth's circumference—being only thirty times the terrestrial diameter away—the moon, although simply a companion planet—the *cadaver* of a worn-out world accompanying the sun in his diurnal journeyings round the earth—exercises a greater influence over the tides than "the fiery day god."

Let us suppose the earth's surface to be covered by an unbroken sheet of water, of uniform density and depth.

The moon attracts with equal force the water and the earth, but the water, possessing a far greater degree of mobility than the firm earth, will be acted

upon proportionally more perceptibly. It will be swelled into a protuberan called an *intumescence*—upon that portion of the earth's surface turned tow the moon. At the point periecian to the vertex of the intumescence thus duced, will be formed a corresponding intumescence of equal proportion every respect. The reasons for the formation of this second intumescenc the same as for the formation of the first—the attraction of the moon an mobility of the water. Perhaps it would be a nearer approach to the tru attribute the antipodical intumescence to the *weakened* influence of l attraction, and the mobility of the water. The waters upon the nether si the earth from the moon, being thousands of miles farther away, would be influenced by the moon's attractions than those upon the hither side; and sessing greater mobility, would be less attracted than the nether portion of earth, and, as it were, *lag behind*, thus forming a protuberance correspondin that produced by the moon's attraction upon the opposite side of the earth.

The swellings of the water at the vertices is called high-tide, and depression at the nadirs—the points 90° distant, either way, from the p where a diameter passing through the vertices of the intumescences cuts terrestrial periphery—is known as low-tide.

Solar and lunar influences, in the production and regulation of tidal s ings, are mutual; though that of the sun is far inferior. When the line of t mutual attractions is identical, the bulk of the solar intumescence will be ad to—placed in superposition to—that of the lunar intumescence, thus produ the phenomena generally denominated spring-tides. This may be designate the conjoined solar-lunar syzygies, and at this time the spring-tides reach t maximum altitude, and the waters at the nadirs sink to their minimum ver depth. This occurs during each new moon. When the sun and moon are u opposite sides of the earth, and their attractions are exerted in the same lin direction, we have what may be designated as opposite solar-lunar syzy This occurs during each full moon. During the prevalence of opposite syzy the tide does not rise as high at the verticese of the intumescence, nor sin low at the nadirs as during conjoined syzygies. During quadrature the solar lunar attractions are opposed to each other, producing what is called neap-ti During the prevalence of quadrature the solar intumescences swell the l nadirs, and detract from the lunar intumescences; and the solar intumesce are in turn depressed by lunar nadirs, and the solar nadirs swelled by l intumescences. If the solar and lunar influences were equipollent du quadrature they would mutually nutralize each other's influence, and t would be no disturbance whatever of the equilibrium of the ocean. But b *un*-equal the amount of disturbance of oceanic equilibrium will be proportio to the excess of lunar above solar influence.

Such would be tidal phenomena if the earth's surface was covered, a have supposed, by an unbroken expanse of water of uniformity of density depth. But the absence of this unbroken envelope of water, the intersper of barriers—in the shape of continents and want of uniformity in density depth—tidal movements are materially modified.

According to Whewell, the Antarctic Ocean—the great father of waters, which sweeps almost uninterruptedly over a whole hemisphere, and from which all the other oceans are simply radiations—is the theater of the most perfect representation of tidal phenomena. Here, a few minutes after the passage of the moon over the meridian, the tidal wave is raised to its full height, and dashed along from shore to shore until finally it breaks upon the coasts of Greenland and Scandinavia. The equilibrium of this hemisphere of water is constantly disturbed by tidal movement. The waves follow each other in regular succession around the earth from east to west, along the apparent path of the sun and moon, describing an orbit similar to the orbits of these celestials.

The waters of the central Indian and Pacific Oceans obey this normal influence, predisposing them to a westward flow. The tide-wave strikes the shores of Australia and New Guinea simultaneously, and between 13 and 14 hours afterwards lashes the eastern coast of Africa from the Bank of Lagullas to Cape Gardafui; and 7 or 8 hours later agitates the waters along the South American coast, from Terra del Fugo to the La Plata.

The solar and lunar intumescences, following each other in uninterrupted succession around the earth from east to west—the contrary direction to that of the diurnal rotation of the earth—their friction against the coasts of continents and islands, and against standing waters, must necessarily form a drag which tends to retard the speed of the rotary motion of the earth—as the deductions of Mayer, Tyndall, Adams, Jaule, Delannay, and others have demonstrated to be inevitable. According to different calculations this retardation amounts to the one-sixteenth of a second in 25 centuries.

The numerous barriers met with in northern latitudes greatly modify normal tide-action. Striking against the barrier-coast of America the tidal waves are deflected from their course, and pursue a course northwards—continuations of the primitive swellings—along the outline of the oceanic basin, striking the coasts of the New and Old Worlds, in a given latitude, at about the same time, and at the same angle of obliquity, reaching synchronously, the Irish Channel and Funday Bay, where they attain their greatest observed altitude—a verticle height of 70 feet.

A tidal wave travels from the Cape of Good Hope to Cornwall—a distance of about 6,000 miles—in about 15 hours. But its entire voyage from "the cradle of the tides"—according to Whewellian phraseology—in the mid-Antarctic Ocean, requires nearly double that length of time; and, because of opposing barriers and other retarding influences, this time is quadrupled before said wave reaches the Thames. And, as Reclus remarks, "the moon would have had time to raise five successive tides in the Pacific Ocean before the motion of the liquid mass would have been propagated to the entrance of the North Sea."

This Whewellian theory, which represents the middle of the Antarctic Ocean as "the cradle of the tides," meets with much opposition from various quarters. Although founded on deductions and generalizations based upon observed phenomena, this theory seems—nay, not *seems*, really is—inadequate to

the explication of various observed phenomena. Close observations hav more recent generalizers to conclude that the center of each oceanic expa "the cradle" from whence radiates the tidal waves which break upon th rounding shores. This theory receives very strong support in the fact tha various oceans are separated from each other by areas where the tide is sca perceptible. "Between the North and South Atlantic," observes the a above cited, "whose precise boundary may be defined by the promonto St. Roque and Cape Verd, there exists a wide zone where the tide h changes the maritime level more than about 23 to 27 inches, as at the islan Ascension and St. Helena."

According to the "cradle" theory, the deflected tide should *set from to north*, but along the Argentine and Brazilian coasts the tide sets *from no south*, from Pernambuco to the La Plata. It has been pertinaciously obs that "when we see a tidal wave rise off the Banks of Newfoundland, i deepest part of the North Atlantic, it is not therefore necessary to conside as the same wave which twelve hours before was raised near the Bank of L las, at the entrance of the South Atlantic. It is, perhaps, better to regar oscillations which occur at the same time in both hemispheres as coinciden independent phenomena."

These two conflicting theories, which are diametrically opposed to other, cannot both be absolutely true. We are inclined to the opinion that are neither wholly false nor wholly true, but that each embraces quantit error. Both are undoubtedly based upon observed phenomena. But, in deductions, observers have assumed local appearances to be ubiquitary nomena; and treated as universal things which are applicable to isolated only. In other words, in the application of the data deducted from obse phenomena, they asserted that to be *universal* which they had nothing to a them was anything more than a *local occurrence* peculiar to the area in w they had made their observations; that is, they have drawn conclusions w exceeded the bounds warranted by their observations. We do not d that the tidal wave, striking against the barrier-coast of America, is flected northwards, as Whewell maintains; but he *assumes* that it follow outline of the oceanic basin, like a mountain torrent does a defile, int higher northern latitudes, whereas in reality it ceases ere it reaches the lati nal parallel of the promontory of St. Roque and Cape Verd. This theo deflected northward flow was undoubtedly maintained by the observa Whewell had made, and extended northward, with apparent unabated forc far as his observations had reached; and, judging the unseen from the seen- unknown from the known, he presumed that the northward flow carried oscillations into the North Sea. But we now know that that was a falla assumption, occasioned by too broad a generalization with the given data; as already observed, along the coasts of Brazil and the Argentine Confedera the tide, instead of flowing northward, as Whewell assumed, flows south from the port of Pernambuco to the mouth of the La Plata River.

We have here but another illustration of the fable of the knights on opposite sides of the shield, one declaring that it was made of gold, the other maintaining that it was made of silver, and near taking each other's life ere they ascertained that one side was gold and the other silver.

The contest is parallel to that of the Aqueous and Igneous schools in geology. There were many well fought battles ere it was understood that the two elements, fire and water, were synergetic chemical agents that worked together in "the vast laboratory of the globe" in the production of the film crust of the earth. The former of these schools contended that the earth's solid envelope had been wholly accumulated under the influence of water; while the disciples of the latter contended, with equally dogmatic pertinacity, that it resulted entirely from the influence of fire. This difference of opinion resulted very naturally from the difference in the prevailing condition of the earth's crust in the areas where the leaders and adherents of the different schools resided. In one area the rocks were evidently of aqueous origin, while in the other they were unquestionably Plutonic;—the one characterized as stratified deposits, and the other as volcanic eruptions. And the observers of the rock-strata, like the observers of the tide-phenomena, extending their generalizations farther than their data warranted, were betrayed into the adoption of an erroneous conclusion.

The disciples of each of these schools were very enthusiastic in the support of the respective theories which they adopted. It is related of Werner, the champion of the aquatic school, that once when on his way to examine a region of peculiar geological interest, being informed that it confirmed the theory of his opponents—the igneous school—he turned round and went home, not desiring to see that which might force him to change his opinions. Thus it has ever been. Men are so prone to hug their espoused theories—particularly if they lay claim to the paternity—and shut their eyes against all antagonistic facts, that they prefer to dwell in perpetual error, rather than see the theory of their opponents confirmed and their own demolished.

Unlike surface waves, which exert very little influence, if any, at a vertical depth exceeding 100 fathoms, tidal waves disturb the aqueous equilibrium from the surface to the bottom of the basin of the ocean, be the depth five or fifty or five thousand fathoms.

The speed with which tidal waves travel, depends upon the depth of the water. Where the vertical depth of the ocean is 5,000 fathoms the speed of the waves is about 528 miles per hour; where the depth is 50 fathoms it is only 60 miles per hour; and where the bottom of the oceanic basin approaches to within five fathoms of the surface there is a flow of but 15 miles per hour.

One of the first things that would attract the attention of coast-dwelling and sea-faring peoples, is the difference in the height at which the tidal waves run in different localities. In some places the tides, even during the conjoined or equinoctial syzygies, scarcely make themselves felt; while at others even the neap-tides are a perfect flood, covering vast areas at each flow, and again

receding and leaving the coast perfectly bare at each ebb. Innumerable the variations in tidal phenomena, because of inequality of the marine bed, numerous indentions of the shores, the variability and alternation of winds currents. Though the *prima causa* be everywhere the same, yet nowhere the tidal phenomena present a perfect agreement in the speed with which waves move and the altitude which they attain. Every object which thw the passage of the oscillations modifies the whole of the graceful curves wl sweep around it.

The cause of the difference in the amplitude of tidal waves at var points is the difference of speed with which they progress. A wave raise mid-ocean, as it approaches the shore, is gradually retarded by the opposi afforded by the gently-rising bottom of the oceanic basin, and gains in altit what it loses in speed. The tidal wave which is precipitated from "the crad instead of being a single magnificent swell, consists of a great number of w which occupy considerable breadth on the surface of the ocean.

At the port of Panama the tide rises nearly 23 feet, breaking with a g deluge upon the coast; while on the other side of the isthmus—only 37 n distant—the flow and ebb are scarcely perceptible. In the Persian Gulf the China Sea the altitude of the tidal wave, during conjoined syzygies, is ne 36 feet. At the mouth of the Severn River and in the Bay of St. Michael, tidal waves attain an altitude of from 45 to 48 feet. In the gulfs of San J and Santa Cruz, the tides rise from 48 to 66 feet in height. In the Ba Fundy, at the entrance, the height of the tidal wave is not quite 9 feet, an the farther extremity it reaches the unsurpassed altitude of 70 feet. Her where the tidal phenomena attain their grandeur. Twice each day imm areas—neutral tracts of lands—belong alternately to the empire of Dem and the realm of Paseidon; and "stranded ships rise and float, with sails spr while towns lost in the interior of the land find themselves seated on penins invested by the sea."

At the mouth of the Severn and in the Bay of St. Michael, creeks rivulets are periodically transformed into gulfs. The harbors are describe a French writer as "tidal ports, where ships, with the exception of those are enclosed within the basins, lie on their sides in the sand or mud at the t of low water." With the return flow of the tide the stranded vessels are launched and sail—carried by the receding tide, which progresses with s swifter than that of a war-steed at full gollop—rapidly over the sea. H during the prevalence of spring-tides, it has been estimated, a liquid ma 1,470,000,000 of cubic yards is thrown upon the neutral shore; and du neap-tides 765,000,000 of cubic yards spread over an area of 150 square m At ebb the waters retreat to a distance of 6½ miles from the shore, leaving l a great desert strand which resembles throughout—except where "interse by subterranean deltas of tributary rivulets, forming here and there treache abysses of soft mud"—an extensive bed of ashes.

Various theories have been advanced for the explanation of this diver

in the tidal phenomena. Disregarding configuration of coasts, depth of basin, and variability of winds and currents, that theory which attributes this diversity to the conjunction of, or the mutual neutralization of, the influence of two systems of tidal waves, is the most plausible. Thus, according to this theory, the crests of the waves of the tide which flows into the Irish Channel meets, at the mouth of the gulf into which the Severn discharges its waters, a wave which, according to the Whewellian theory, has just made the circuit of Ireland, and is 12 hours older. These two waves, coalescing, flow into the Gulf of Severn. And the tide which enters the English Channel meets, off Jersey Isle, another wave, which, having circumnavigated the British Isles, is at least 24 hours older, and the two uniting break with violence upon the rocky strand of Brittany.

If these tidal waves set in from opposite directions, they suppress and nutralize each other's influence when the ebb of one crosses the flow of the other. The calmness of the area in the region of the La Plata is the result of this movement. The tidal waves flowing south along the Brazilian shores, and those flowing north along the Pategonian coasts, do not reach the estuary of the La Plata at precisely the same time, but differ several hours in their arrival; so that when the northern ebb occurs the southern flow takes place, thereby maintaining the equilibrium of the surface; and during the southern ebb the northern flow neutralizes its disturbing influence, thereby preserving a constancy of the stability of the oceanic surface, so far, at least, as ebb and flow are concerned. There occur here, however, oscillations very similar in appearance to tidal phenomena. But they are common waves and not tidal waves. They are due entirely to the currents of air which move over the surface of the water. The "land winds" prevail in the morning, and are displaced by the "sea breezes" in the afternoon; consequently the "tide"—as the waves thus produced are denominated by the shore-dwellers—rises in the afternoon and falls in the morning, with unvarying regularity of alternation.

Finally at Tahiti four tides, coming from the four points of space, meet each other, all differing in speed and time of arrival. The result, as we would naturally expect, is an almost complete mutual neutralization, and consequent suppression of all tidal phenomena.

THE BARN SWALLOW.

(*Hirundo Horreorum.*)

This beautiful and familiar bird is one of the most elegant and graceful our ærial visitors. It is common in summer from Mexico to the extreme n ern portions of North America, being found in Alaska, Greenland and all North America, from the Atlantic to the Pacific oceans. In M West Indies, Central America, and the warmer parts of South Am it is also very common. It appears to withdraw altogether from United States in winter, although a few individuals are very arrivals in the Southern States, even appearing in February. The great po of flight possessed by this species, enable it to pass rapidly and with ease one country to another, according to its whims or the exigences of the we It breeds throughout the whole of this extensive range, venturing with confi trust into our crowded cities, associating in great numbers about the haun breeding in the barns and farm-buildings of the agriculturist. I and confiding, they, by their social and gentle manners, endear thems and are universal favorites wherever found. They are our con by destroying immense quantities of injurious insects, which i multiply would surely destroy the hard-earned labors of the human barn swallow has never been known to do the least injury, direct indirectly to man, and well merits the protection he so universally rece They are kind, affectionate and social in their intercourse with each ot and faithful and devoted to their young. This species passes the winter in tral and South America, as far south as Brazil and Paraguay. In Mexico found throughout the year. It usually arrives in the Southern States ear March, and in the Central States, early in April. In the latter part of Ap reaches New York State, arriving in New England about the first of May. wild, unsettled districts at the present time, and everywhere, before the ad of civilization, the barn swallow built in caves, fissures and hollows in ro but as the country becomes settled, they voluntarily forsake these retreats resort to the more convenient and safer accommodations afforded by the st tures built by human hands.

Perhaps this species is the most beautiful of all the American swall Graceful in form and motion, brilliant in coloring, it is a striking object w ever and whenever seen—especially so when gracefully circling over l through the air in pursuit of its insect prey, displaying in the sunlight the liant red and blue of its glossy plumage.

The nest of the barn swallow is a somewhat complicated structure. Its f is that of an inverted cone, with a vertical section cut off on the side w is attached to the wall. At the top is an extension of the edge or rim, in form of a platform, for the parent birds to roost upon. This perch is t inches long, one and one-half inches wide, and $\frac{3}{8}$ inch thick. The shell of nest is composed of mud and fine dry grass, placed in ten or eleven alter

layers; the first or outer strata being one of mud. The mud is worked into small pellets and formed into a plaster, which hardens with age. This is laid in a thick strata, with a layer of grass between each strata of mud, thus forming a shell of the total thickness of one inch. This cone is seven inches high externally, and six inches in greatest diameter, and five inches in its least diameter. The hollow of this cone is warmly lined, first with fine soft hay, and inside of this with downy feathers. The cavity inside is two inches deep, and its diameter at the rim is three inches. The whole weighs two pounds. In favorable seasons the barn swallow raises three broods in a season, but generally only two. The eggs are usually five, sometimes six, in number. They are white, marked with reddish spots all over the shell, which is so transparent as to appear slightly of a flesh color, giving the white a pinkish tinge. They are 25-32 of an inch long by 9-16 of an inch wide. The period of incubation is thirteen days. The first brood makes its appearance about the second week in June and the second brood leaves the nest about the tenth of August. So social and loving is the disposition of these little birds, that as many as fifty pair frequently breed in one barn, the nests being only a few inches apart, and yet they live in the greatest peace and harmony. When the young are ready to forsake the nest the parents entice them by many an artifice and lesson to try their wings in flight. Their first efforts are made inside the barn, before they venture outside.

The flight of the barn swallow is wonderfully rapid, easy and long-sustained. The many quick, intricate, and tortuous evolutions, the repeated and zig-zag flights and turns executed, are so striking and interesting as to excite the admiration of every beholder. This flight is sustained without intermission from morning to night, and has been estimated at over ninety miles an hour. They bathe and drink upon the wing while flying over the surface of the water. The song of the barn swallow consists of a melodious succession of sprightly twitterings, uttered with great rapidity and animation as they fly through the air after their insect prey. When perched they utter this song more slowly and with less animation. The attention this species gives to its young is extremely tender and unremitting. They leave Ohio for the South as soon as the second brood is prepared to fly, or early in September. They usually all collect in flocks, sometimes numbering several hundred, and depart in a few days after collecting together. After the young are able to fly they are frequently fed by the parents while on the wing, "by an almost instantaneous motion of both parties, rising perpendicular in the air and meeting each other." The barn swallow is very easily tamed and soon becomes exceedingly gentle and familiar, catching the flies about the room and even perching upon its protectors and picking these insects from their clothes.

The barn swallow is of a beautiful and glossy steel-blue above, with a patch of concealed white in the middle of the back, not seen unless the feathers are parted; forehead and throat, chestnut; rest of the lower parts, reddish white, often nearly as dark as the throat. A steel-blue collar crosses the upper part of

the breast, interrupted in the middle; tail and wing quills, brownish b each tail feather—except the two middle ones, which are plain—has a sp white situated at the center of each feather and occupying the entire inne to the shaft; under wing coverts, reddish white; lores, black; iris, dark b bill, black; legs and feet, dark purple; sides of the mouth, yellow.

DETAILED MEASUREMENTS.

Tip of bill to forehead - - -	5-16 of an inch.
Tip of bill to hind head - -	1 1-8 inches.
Tip of bill to outer corner of eye -	5-8 of an inch.
Tip of bill to outer corner of nostril -	2-8 "
Tip of bill to corner of mouth - -	5-8 "
Tip of bill to chin feathers -	3-16 "
Tip of bill to end of longest tail feather	7 1-8 inches.
Tip of bill to middle toe - -	5 3-8 "
Width of bill at base, inner corner of nostril,	2-8 of an inch.
Width of bill at corner of mouth, inside,	3-8 "
Heighth of bill at base - - -	1-8 "
Diameter of eye - - -	1-8 "
Diameter of nostrils - - -	1-32 "
Carpal-joint to end of longest primary	4 6-8 "
Carpal-joint to end of secondaries -	2 1-2 "
Tail outer and longest feather -	3 3-8 inches long.
Tail middle and shortest feather -	2 " "
Tail beyond upper coverts - -	1 7-8
Tail beyond lower coverts - -	1 1-2 } Measured on the
Tail beyond longest primary -	6-8 tail feather.
Tail beyond end of middle toe - -	1 7-8

Although the outer and longest tail feather extends 6-8 of an inch be the longest primary, yet this primary stretches 5-8 of an inch beyond the en the middle and shortest tail feather.

Tarsus - - - - -	4-8 of an inch long.
Tibea - - - -	1 inch long.
Middle toe - - - -	7-16 in.; its claw, 2-8 in.
Outside toe - - - -	2-8 in.; " 3-16
Inside toe - - - -	2-8 in.; " 3-16
Hind toe - - - -	2-8 in.; " 2-8

The tail is composed of twelve feathers, the outer one on each side l the longest, and fully 1 3-8 inches longer than the middle pair; the outer fe is also 6-8 of an inch longer than the second or next feather adjoining it.

First wing quill longest; second, 1-8 inch shorter.

First, 2 1-2 inches longer than the secondaries.

Extent of wings, 13 2-8 inches.

The bill is contained in the head three and one-half times; it is flat

triangular; the height at base about 1-3 its length; its width at base about 2-3 its length. Tarsus equal to middle toe; lateral toes equal; their claws reach base claw on middle toe. Hind toe about equal to lateral toe, its claw equal to its digit.

LIVING LIGHTS.

In a sequestered nook in the midst of the forest is a clear tranquil pond. Its margin is surrounded by mossy banks and bending reeds, dotted with yellow buttercups and pale white lilies, intermingled with the purple iris supported by its long slender green leaves and graceful stems. Its clear pellucid surface reflects the passing clouds above, and mirrors in its tranquil bosom the tall trunks of the trees which line its banks, forming a living canopy of waving green. There in this quiet sylvan glade, where the bright sunshine, excluded from the depths of the forest, gladdens and glorifies all nature, shedding a sheen of gold over the scene, the gaily tinted butterfly delights to revel among the flowers, the graceful dragon flies and tiny gnats sport and dance in the sunshine, while the pretty little humming bird sips the nectar from many a painted cup. But, though nature is so lavish by day in her gifts and charms in this favored spot, it is by night that she bestows many an added beauty, many a sweet note to enhance the already numerous attractions here concentrated, as if to lure the visitor to her side. Then, as soon as the moon sheds her pale beams upon the forest glades and mirrors her face in the tranquil bosom of the little lake, tipping each wavelet with a crest of silver and casting a broad stripe of mellow light across its surface, disclosing deep shadows in the surrounding forests. The night birds flit past on noiseless wings like spectres from the depths of the forest, while the bat—that strange creature of caves and ruins—is seen wending its way across the surface of the pond. Moths, millers and beetles issue from their concealment and flit among the leaves, while the air over the lake and in the woods beyond is full of dancing lights, spangling the scene with myriads of brilliant little stars which wander here and there like tiny lamps. There are not a few such peaceful little sunshiny spots, set like gems in the dark perpetual shade and twilight of the unbroken forest. In the day time they tempt one to linger by the warm and bright sunshine, the velvety green carpet, dotted with many tinted flowers, spread at our feet, and the mossy banks where painted cups and "lady slippers" lift their beautiful heads amidst the green. Such sequestered nooks, by their bright and vivid colors, form a charming contrast to the dark and gloomy forests which surround them, rendering them doubly delightful.

One of the greatest attractions to an evening in the country in the summer season, are these numerous little lamps, seen dancing here and there among the green foliage of the forest or garden, or darting through the midnight air like tiny fiery meteors. These little shining stars are the light-winged fire-flies—a small nocturnal beetle, belonging to the genus *Lampyris*—which produce a

beautiful effect at night, as they fly in and out among our shrubbery. T are many species of this genus. The American fire-fly is a small beetle, female of which is called the glow-worm. The eggs of the glow-worm, larvæ and nymphs are all luminous. The eggs are hatched after a few we The larvæ resemble the perfect females—having twelve segments, the first t of which bear each a pair of feet. The head is small, and, like the ca segments, retractile. The glow-worm will thrive well in captivity, if kep moist earth or herbage, and will eat slugs and snails, which they kill with t arched and pointed jaws. About a week is occupied in assuming the stat nymph, and in eight days longer they appear as perfect insects. The nymp larger than the larvæ, but not quite so long. In the perfect female the alim tary canal is twice as long as the body, and the œsophagus short, immedi dilating into a crop. When the glow-worm has arrived at its perfect sta changes its food from animal substances to vegetable food, therefore the l cannot be raised upon vegetable food alone; besides moist herbage and d earth small land shells must be provided for its sustenance. The head of fire-fly is small, almost entirely occupied by the eyes, and concealed by the h plate of the thorax; the antennæ are short, with cylindrical and compr articulations; the legs simple; the elytra are coriaceous; the abdomen is rated on the sides. The females have only rudiments of elytra at the ba the abdomen. There are many species of fire-fly in the United States, of w the *Lampyris Scintillans* is one of the most common and best known. *L. Corusca* is another familiar species; it is $4\frac{3}{4}$ lines long; the body is ol pubescent, brownish black; a rose-colored arched streak, dilated and yellow anteriorly; joins, the elevated thoracic disc. The elytra are obsol carinated with numerous minute dots. Both sexes are luminous, althoug female is most brilliant. The light proceeds from the three last segments o body. They conceal themselves by day in secluded places. The male from plant to plant, while the females remain quiet, betraying themselves by bright greenish or bluish light. This species is found as far north as Some of the tropical species are very brilliant. One species, the *Pyroph Noctilucus*, of the West Indies, is more than an inch long. Its light proc from the two oval tubercles on the dorsal surface of the thorax, and from under surface of the segments of the body, and is so brilliant as to be visib broad day light, and so intense as to cast a shadow of any object upon the o site wall of a dark room. The under side of the thorax appears as if red When held in the hand it emits a green light, but when flying it diffuses glare; the green light is emitted at any time, the red light only during fl Occasionally both lights are shown at the same time while flying, produci brilliant and beautiful effect. The thoracic light is under the control of insect, but the abdominal light is involuntary; the former is intermittent the latter shines with a constant red glare, which will illuminate the groun the space of a yard square. The natives sometimes use these insects to illu ate their dwellings and to light their way while traveling, three or four put

glass bottle giving light enough to read small print by. At night the forests are rendered brilliant by these living lamps.

The *Pygolampis Xanthophotis* is another species found in Jamaica. It is ¾ of an inch long and ⅛ of an inch wide; the wings, smoke black; thorax, drab; dark brown in the center; abdomen, pale—the last three or four segments, cream white. The light of this species is very intense, of a rich orange color, and intermittent. The *P Versicolor*, another West Indian species, is drab color, on the elytra. The light is green. When at rest its light gradually increases in intensity to its brightest, then by degrees diminishes, remaining dark for one or two minutes, shining and fading again like a revolving light in a light house. Many ladies use these brilliant insects as ornaments upon their dress, producing a striking effect at night. Naturalists enumerate from two to three hundred species of luminous beetles in the whole world. These are restricted to but two families—the Lampyridœ and Elateridœ.

Some species of centipedes and earth worms are luminous, and when the sod is upturned emit a faint glow of pale yellow light.

But it is not alone upon the land that these living lights are seen. The seas are also illuminated by innumerable sparks of light, until frequently the whole surface of the water for long distances appears to glow with a brilliant flame. This is occasioned by many species of animalcules, many infusoria and noctilucea. The radiata also possess high phosphorescent qualities. Star fish, sea-pens, sea-rushes, sea-fans and jelly fish all shine with a mild radiance. In the star-fish the light is not continuous all over the star, but flashes out a line of fire all around the disc, in a circle around the centre, then fading out. Again a patch will glow in the middle of one arm, and travel slowly out to the point of the ray, or, at another time, the whole five rays will light up at the tips and run rapidly inwards until the fire spreads all over them to the centre of the star. The light is not constant, but flashes up and fades away at irregular intervals. The light of the star-fish is of a brilliant green. The sea-pens and sea-fans usually emit a white light, but one was once caught which shone with a pale lilac light.

Some of the most beautiful luminous appearances of the ocean are occasioned by members of the mollusca.

Among others is a species of shelless mollusk found in the equatorial regions of the Atlantic, resembling a small cylinder of incandescent matter. It is microscopic in size—so small that it is invisible to the naked eye; but great numbers adhere together, forming a cylinder six to fourteen inches long. The sea often glows like a lake of fire from the prodigious numbers of these tiny tribes floating upon its surface. The color also varies from red to orange, green and blue. Another species adheres together in the form of long ribbons, appearing like long drawn-out bands of fire, curving with the waves or drawn out in direct lines by the action of the currents. It is found in the Mediterranean Sea.

Among the Annelida and Crustacea are many examples of animal phos-

phorescence. These minute worm-like creatures are especially brilliant w the sea is agitated—the water being illuminated by sparks of light, vanis and reappearing in countless myriads. The ropes and net work of dre drawn up from the sea are often studded with bright stars and resplendent s of light occasioned by the numerous minute infusoria adhering to its meshe

But perhaps of all marine inhabitants the *Pyrosomas* are the most brill and do full justice to their name (fire bodies). The naturalist, Bibra, says six of them gave light enough to read by. They emit a blue-green light. W a ship passes through a shoal of these mollusks, the whole surface of the o gleams with a bright and brilliant light, the ship appearing to be surrounded flame of bright glaring light, which covers the waters for miles in every direc presenting a magnificent spectacle not soon forgotten—the vessel appearin plow its way through liquid fire, and throwing up flashes and stars of brilliant d of light as it cleaves the waves. These animals are about seven inches lon

The *Pholades* or *Lithodonees*, noted for boring into hard stone, shine with a phosphoric light. These little beings are so permeated with p phoric light that they shine in the mouth when eaten, and the juices, as drop off, glow like balls of fire. Several species of fish have the power of gi off light, as, for example, the sun-fish, some species of gurnard, and ce sharks; but this luminosity of the larger animals may be occasioned by small, parasitic beings with which their bodies are more or less infested.

This phosphoresence of the oceans is not confined to any particular loc or climate, but is equally as common in the Arctic as the tropical regions. uses of this phenomena are yet subjects of speculation, but a phenomena grand and wide-spread a character must be of some useful and necessary Whether it is for the purpose of attracting to themselves their prey, or for purpose of lighting their way through the world of waters, is not known. the waves upon our coasts should glimmer and sparkle in the night like m silver when the sea is comparatively calm, and show no such light durir storm, is because the luminosity is occasioned by living creatures of small who seek the depths of the waters during a storm, and sport upon the su in warm and calm weather.

Sir Walter Scott thus describes this phenomenon of light at sea:

"Awak'd before the rushing prow,
The mimic fires of ocean glow,
Those lightnings of the wave;
Wild sparkles crest the broken tides,
And flashing round the vessel's sides
With elfish lustre lave;
While, far behind, their livid light
To the dark billows of the night
A blooming splendor gave."

The cause of the light of these animals has long been the subject of ca study and discussion by naturalists. The luminous tissue is made of globules, permeated by numerous trachæ conveying air, with no traces of n or blood-vessels; it absorbs oxygen, and gives out carbonic acid, but no ceptible heat. *H.*

AMBER.

Perhaps no production of nature has excited more curiosity and interest than amber. Found in loose and detached pieces, scattered in alluvial deposits, or strewn along the coasts, after storms have swept the bottom of the sea, the origin of its clear, crystal-like drops has ever been shrouded in mystery. The ancient Greeks and Romans, with that romantic spirit of poetry for which they have ever been noted, regarded amber with superstition and mystery. They supposed it to be tear-drops, shed by beautiful sea and wood nymphs, petrified as they fell upon sea or shore. The electrical phenomena exhibited by this substance, inhanced its already numerous mysterious qualities, and many an ancient philosopher went so far as to give amber a soul.

The beautiful transparent color of amber, and its smooth and polished surfaces, have always given it a certain intrinsic value as an ornament. It is now generally supposed to be of vegetable origin, a fossilized vegetable gum, the trees which produced it being now extinct, stood in forests in past epochs, and now lie in stratas of bituminous wood beneath beds of sand and clay. The wood is more or less impregnated with amber, and it is also found depending from the branches and trunks in the form of stalactites, and in rounded drops or pieces, mixed with pyrites and coarse sand, under the layer of trees. In some places amber is found in beds of brown coal and lignite, and the pieces picked up on the sea shore, have probably been washed out from submarine deposits, similar to those upon the land. The fishing and picking of amber from the sea, gives employment to a great number of persons. This is generally undertaken after a storm. The men wade into the sea and catch in nets the seaweed which is swept in by the waves. This is spread upon the shore, and the amber that is attached to it, is picked off by the women and children. Amber is also procured from mines, excavated into the immense sunken forests, where it is taken from the strata of fallen trees. Such a bed is worked in Prussia. Here the layer of trees is forty or fifty feet thick, and is situated one hundred feet below the surface of the ground.

Amber is not only found near the sea shore, but at great distances in the interior, more or less deep beneath the surface of the earth. Amber occurs in nodules, or roundish masses, from the size of a grain of sand, or small pin's head, to that of a man's head. The largest specimen ever found weighed eighteen pounds, and is in the royal cabinet at Berlin. It was found in Lithuania, twelve miles back from the Baltic sea. Amber has a conchoidal fracture; it is transparent and translucent; possesses a single refraction of light, and a resinous lustre; it is of a wine or wax yellow color; sometimes a greenish or yellowish white, or reddish brown tint is seen; at others the colors vary in layers. Its specific gravity is 1.08. It is hard, and susceptible of a fine polish. It becomes electric by rubbing, and workmen engaged upon it are obliged to frequently change the pieces they are at work upon, that the excited electricity may be dispersed. When rubbed it becomes negatively electrical. Heated, at

448° F. it melts and then takes fire, burning with a yellow or blueish gr flame, emitting at the same time a dense black smoke and an agreeable oc and leaving a carbonaceous residuum. It scratches gypsum, but is attacked carbonate of lime. Its streak-powder is yellowish white. By analysis it gi carbon from 70 to 80 per cent., hydrogen 7 to 11, and oxygen 7 to 8. Its p cipal ingredients are a resin insoluble in alcohol, which forms 80 to 90 per c of the whole. With this is also found a resin soluble with difficulty in alco and the trace of an odorous volatile oil. The products of distillation are flammable gases, water holding succinic and acetic acids, and empyreumatic in solution—the spirits of amber—sublimed succinic acid—salt of amber—: an empyreumatic oil—oil of amber. The residue is 12 to 13 per cent. of cl coal.

Amber is used chiefly for ornaments, as bracelets, necklaces, buttons, c drops and pins, and for the mouth pieces of pipes and cigar-holders. A varr is prepared from it, as well as an oil used in medicine, and succinic aci useful reagent in chemical operations.

The geological distribution of amber, is in the green sandstone format and the clays that succeed it. The principal localities in the Uni States where it is found are at Cape Sable, Maryland; Amboy, New Jers and Gay's Head on Martha's Vineyard. Pieces of amber are often found v insects entombed within them. These insects are either entire or broken, : often exhibit evidences of a severe struggle to disengage themselves, before t succumbed to their fate, the lines of light being broken and made prismatic a short distance all around the little captives. Sometimes they are with wings or a head, or otherwise mutilated. In one instance a portion c spider's web, with a small fly and the spider were found enclosed in a glol of amber; in another a scorpion was contained; one specimen enclosed a l and another a brilliant and gorgeous beetle. The colors of the substance enveloped remain, and do not change. A small, round red berry was fou perfectly preserved in one specimen of amber. In one perfect piece of am a drop of dew was enclosed and preserved. Moths and millers are frequei found in pieces of amber. A cobweb, with a dewdrop and small spider atta ed, was found in the centre of another specimen of amber, in such a manne to indicate that the web was attached to the branch from which the liquid am descended, and carried it with it as it fell, enclosing web, dewdrop and spi Fern leaves and small pebbles are also often found enclosed in amber dr All the insects thus found enclosed in amber, are extinct species, not now fo living upon the earth, and are therefore very interesting objects of study to scientific investigator. For this reason, and for their beauty, novelty, and c parative rarity, such specimens of amber command a high price, and are m sought after.

The value of specimens of amber is not at all proportionate to their s but depends upon the clearness, transparency, and brightness of the color. piece of a pound in weight, of pure, transparent wine yellow, would bring

The clearer the color, and the more transparent the specimen, the higher the price it will bring. Amber may be mended by a cement of linseed oil, gum mastic and litharge, or by moistening the ends of both pieces with potash, warming the same, and pressing the parts together.

Amber possesses the property of attracting light substances to itself when rubbed. This characteristic was known to the ancients, being mentioned by Thales of Miletus, and Theophrastus, B. C. 321. It was worn as an amulet, to protect the wearer from evil, and was also used as a medicine.

THE PURPLE MARTIN.

(*Progne Purpurea.*)

This is the largest of all our swallows, and surpassed by none in gracefulness and power of flight. The purple martin seems to be a universal favorite of man, and wherever he comes he finds some hospitable retreat fitted up for his accommodation. This elegant and graceful bird is common to the whole of North America, and breeds wherever found on this continent, from the Atlantic to the Pacific Oceans. It is found in the Bermuda Islands, and is resident in the mountainous regions of Mexico. Specimens have been captured in England and Ireland, attesting to its wide range of wandering. It is also very common in Brazil, especially about Rio de Janeiro. It is distributed throughout the whole of tropical South America.

Before the settlement of this country the natural resort of this species for breeding and shelter was to hollow trees, and holes and fissures in rocks. The settlement of the country and the introduction of safer and more suitable places have wrought a complete change in the habits of this species. It now seldom resorts to its former haunts, although it still does so when no better provision can be had. Convenient boxes are provided for its accommodation in our cities and towns, and frequently upon farms, to which they willingly resort, and repay their kind benefactors by their familiar and confiding dispositions, and by the immense number of noxious and injurious insects they destroy. They are also bold and courageous,and will not permit a hawk, eagle, or other bird of prey to visit their territory while nesting, attacking them with great fury; rising above them they peck at them until the larger bird is glad to get rid of the little persecutors by flight.

The purple martin arrives from the south, in Ohio, about the first of April. Within the Arctic circle it arrives earlier than any other swallow—appearing while the ground is still covered with snow, and the rivers and lakes with ice. In fact its early migrations sometimes expose it to great sufferings from the severe changes of the weather, and numbers have been known to perish from exposure. The martin arrives in the southern frontier of the United States late in February or early in March; reaches Pennsylvania about the first of

April; arrives at Hudson's Bay sometime in May, and leaves that district August. In the Southern States it has three broods in a season. In the m northern regions it raises but one. Thus it advances slowly with the grad approach of warm weather, and retires with its young family, upon the decl of summer, to a more congenial climate.

About the 20th of April the martin begins to build its nest. This loosely constructed of dry leaves, straws, stems of grasses, string, bits of r small twigs, hay and feathers, carelessly put together, and lined with feath or other soft materials. The same nest is used year after year by the s pair; but with each brood it is thoroughly repaired. The eggs are f small for the size of the bird, oblong-oval in shape, pointed at one e and are pure white, without any spots; the size of the egg is .94 of an i long by .79 of an inch wide. In Ohio the first brood appears in May, and second in the latter part of July. While the female is laying both parents away from home the greater part of the time; but when the female is sitt the male frequently visits her, encouraging her by his lively and endear twitter. He also occupies her place while she takes a short recreation abro Sometimes he passes a quarter of an hour in the nest beside her; his n during this period are very soft and tender. Conjugal fidelity is very str and faithfully preserved by this species. The period of incubation is fourt days. The food of this species consists of wasps, bees, large beetles, and ot of the larger insects.

About the 20th of August they leave Ohio for the south. The flight of purple martin is exceedingly graceful, easy, buoyant, and long sustained. passes through the crowded streets of the city, eluding all obstacles with quickness of thought; he skims like a meteor after a passing insect, or play an immense height among the clouds—gliding about like an aerial being. bathes and drinks upon the wing, and performs various aerial evolutions w ease and grace. The number of injurious insects this little bird destroy amazing, and should entitle him to the protection of everyone. Its song i succession of twitters, which, although not musical, are pleasing and agreea This is begun at the earliest peep of dawn, and, during the earlier periods incubation, is kept up almost constantly. The martin does not remain in portion of the United States during the winter, but passes south upon approach of cold weather, wintering in South America.

Should a large colony settle near each other the utmost harmony prev They perch easily upon trees, and, notwithstanding the shortness of their l walk well on the ground. They are much attached to their breeding-pla and return year after year to the same spot.

The migration south of the martin is regulated in a great degree by season, and therefore varies as the season is advanced or backward. It is accustomed to stop at some particular localities upon its southern journey several days and then resume its flight. It generally chooses high and unset hillsides in the vicinity of the sea-shore for such stopping-places.

Description.

The purple martin is entirely of a glossy steel-blue, with a purplish gloss; the tail and wings, excepting the lesser and middle wing coverts, are of a brownish-black; a concealed spot of white on the side under the wings; the concealed central portion of the anal feathers are whitish-grey; bill and feet brownish-black. Female and young are duller beneath, being pale smoky-brown, with blotches of steel-blue and black. Sometimes the central line of the abdomen is whitish in the female.

Detailed Measurements.

Length—Tip of bill to end of longest tail feather 8½ inches.
Tip of bill to forehead ½ an inch.
" " nostrils ⅜ inch.
" " eye ⅞ inch.
" " ear 1⅛ inches.
" " corner of mouth 1 inch.
" " hind head 1⅝ inches.
" " tip of claw on middle toe 7 7-16ths inches.
Tarsus ¾ inch long.
Tibea 1¼ inches.
Middle-toe ⅝ inch long; its claw 5-16ths inch.
Outside-toe ⅜ inch long; its claw ¼ inch.
Inside-toe ⅜ inch long; its claw ¼ inch.
Hind-toe 5-16ths inch long; its claw ⅜ inch.
} All on curve.
Carpal-joint to end longest primary 6 inches long.
" " " secondaries 3¼ inches.
Tail outer feather 3 5-16ths inches long.
" middle feather 2¼ inches long.
" beyond upper coverts 1½ inches.
" " lower coverts 1 inch.
" " secondaries 2⅞ inches.
" " claw or middle-toe 1 inch.
Diameter of eye 3-16ths inch.
" nostrils ¾ of ⅛ of an inch.
" ear ⅛ inch.
Width bill on inside, at corner of mouth, ¾ inch.
Tip of lower mandible to chin feathers ¼ inch.
Depth of the fork to the tail ⅞ inch.
Extent of wings 16½ inches.

Six plates on the tarsi in front, the upper one covering three-fourths of the length; eleven on middle-toe, nine on top of each of the lateral toes, and six on the hind-toe.

The wings reach to the end of the longest tail feather; the first quill is the longest. Tarsus is a little shorter than the middle-toe, and equal to the

bill; lateral-toe and claws equal—their claws reach to the base of the claw the middle-toe; claw on the hind toe reaches centre of claw on middle-t Tail equal to wing carpal-joint to end secondaries. Bill contained three tin in the head; it is short, triangular, stout and somewhat depressed at the ba Nostrils—basal, open, superior. The first and largest quill extends 3¼ inc beyond the end of the secondaries. Thus the secondaries cover one-half the wing. The tail is contained twice in the wing. The claw on the hind-t on its top curve, is equal to its digit. The top ridge of the bill is just half gape.

LAPIS LAZULI.

This beautiful azure stone is highly esteemed for its exquisite color, as ornament. It is a mineral found in Persia, Lake Baikel in Siberia, Buch Chili, and California. It is commonly obtained of massive form, and of co pact or granular structure. It is not affected by the weather, air or light. its native state it frequently occurs in small crystals, of a brililant, pure az blue color. These crystals are always twelve-sided. Its hardness is 5.5, s cific gravity 2.38, crystals 2,959. Generally when melted by the blow-pipe loses its blue color, but a variety from Chili recovers it on cooling after calci tion. The mineral is a silicate of soda, lime, and alumina, with a sulphure iron and sodium. The following analysis, by Clement and Desormes, is reg ed as the best given:

Silica,	35.8
Alumina,	34.8
Soda,	23.2
Carb. Lime,	3.1
Sulphur,	3.1
	100.0

Lapis Lazuli occurs in calcareous rocks, associated and sometimes mi with mica, and iron pyrites. It cuts glass, and emits sparks when struc steel. It takes a beautiful polish, and can be cut and sculptured into vases, c and other ornamental objects. It fuses to a white glass, and, if calcined reduced to a powder, loses its color, and turns to a jelly in muriatic acid. W borax it effervesces, and forms a colorless glass. When mixed with the phurate of iron, it presents a beautiful appearance, the golden yellow spec the iron pyrites studding the clear, crystal, azure blue of the lapis lazuli. stars in a calm blue sky.

Lapis lazuli was formerly used to manufacture a blue pigment, and as i the best stone only two or three per cent. can be obtained, this pigment is expensive, costing its weight in gold. The same and equally good pigme now obtained from artificial means. In the Orloff palace, in St. Petersburg

apartments lined with lapis lazuli, presenting a magnificent appearance. Lapis lazuli seldom occurs crystalized. Its regular form is the oblique four-sided prism. It is commonly found compact, and in grains and specks, with an uneven and conchoidal fracture; it is translucent on the edges, its lustre nearly vitreous and shining, and structure foliated.

MACKINAW.

Mackinaw, or, as it is aptly called, "The Key of the Lakes," is a small island situated at the eastern entrance to the Straits of Mackinaw, which unite the two great lakes of Michigan and Huron. Thus situated, it commands the entrance to three of the great lakes and that immense inland sea, Georgian Bay. All boats passing from Lake Huron into Lakes Superior or Michigan are obliged to pass near this island, so that its importance in a military point of view cannot be overestimated. In former times it was the seat of an important Indian trading post, where various tribes from great distances came together to barter and trade twice a year. At present it has become quite a fashionable summer resort. It is also the county seat of Mackinaw county, Michigan. It has a safe and deep harbor. The United States government have a military post here, which is situated on a rocky eminence 150 feet high, commanding the village and entrance to the harbor. The village contains several churches, the county buildings, a number of stores, four hotels, two saw mills, and a number of schools. The island is hilly, the highest point being near the southeastern extremity. The island is about three miles long, north to south, and one and two-thirds miles wide east to west—nearly circular in form—and is heavily wooded. It contains several natural curiosities, among which is the arched rock, situated on the eastern side. This is 140 feet above the lake. The ever restless surges of the lake, unable to reach the solid and adamantine brow of the precipice, have mined beneath it, deeply perforating the limestone wall, forming a natural bridge which hangs there suspended, as at were, at that dizzy height, its fairy-like arch resting upon a winged abutment stretching toward the lake.

Mackinaw Island.

Another natural curiosity is Sugar Loaf, a remarkably slender conical dome, which rises 134 feet from the high plateau of the island, which is itself 150 feet above the lake. Its apex is pointed and sides remarkably smooth. This is a remnant of the rocks of the upper plateau that once extended over the entire island. It is a mass of brecciated limestone, whose sides bear the marks of waves. On one of its sides is an ancient grotto, excavated in former ages by the waves of the lake which once rolled its waters at this great height above its present level. This grand central plateau of the island is

WOOD PEWEE—NATURAL SIZE.

bounded at nearly all points by an abrupt wall extending perpendicula into the deep waters of the lake. In the sides of these walls are many grot and wave-worn projections. At one point is a high vertical cliff, called Lov Leap. In another place is a tall, slender needle-like pinnacle, tapering to great height of 131 feet. All around the walls of this charming island waves have formed caves, grottos and wave lines, which lend a varied beautiful effect to the scene. The highest point of Mackinaw Island is feet. The island is only three miles in diameter. Its name signifies " turtle," from a fancied resemblance in the contours of the island to the form that animal.

The commanding position of Mackinaw did not escape the keen eye the Jesuits. Dablon speaks of it as early as 1670, as the center of the gr lakes. They very early established a missionary station there, and from that to this it has been an important trading point. It was long a post of the trade, and here many " councils " were held.

The climate at Mackinaw, although severe in winter, is cool and pleas in summer, the extreme heat being mitigated by the lake breezes. The m temperature for each month of the year is: January, 18.93; February, 17. March, 26.32; April, 32.85; May, 50.59; June, 61.14; July, 66.74; Aug 63.29; September, 54.84; October, 48.63; November, 35 60; December, 23 Mean for the year, 41.67. The highest range of thermometer, June, lowest, January, —17°.

Upon the island are many boulders, showing that the drift must have o covered the island. They were probably brought from the Lake Supe region. Although found on Mackinaw, they are entirely wanting on Bois Bl and Round islands, in its near vicinity.

THE WOOD PEWEE.

(*Contopus Virens.*)

This little wood nymph is one of the latest of our summer birds, sel arriving before the twelfth or fifteenth of May, according to the season. frequents the darkest and deepest forests, keeping in the shadiest and n secluded forest nooks. It loves high timbered woods where there is little un wood and an abundance of dead twigs and branches extending across gloom, generally in low situations. Here, where the rays of the sun sel penetrate and a perpetual twilight prevails, its soft melancholy and plain note echoes through the deep aisles of the forests. It loves to sit on one of highest dry branches amidst the gloom of the thick woods and warble its pl tive song, occasionally darting after an insect, making a sweep of thirty or f yards, snapping its bill as it captures its prey and returning to its former p to chant its lay as before. In the latter part of August the song of the W

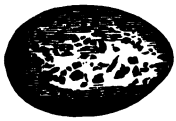
Pewee is almost the only note heard in the woods. About the middle of September it retires to the South. In the fall it sometimes approaches the habitations of man, and is even seen about the parks of our cities, training its young to catch their insect prey. At this time it also delights to frequent the edges of still ponds surrounded by woods. Its flight is swift, with sudden sweeps in pursuit of its food. It will seize with certainty moths and other nocturnal insects when it is quite dark. It also feeds upon various kinds of berries.

The Wood Pewee builds a delicate nest of moss and lichens. It is placed upon the upper side of a dead branch of a tree, usually one of the lower limbs, ten to thirty feet from the ground—choosing one that is covered with small lichens, saddling its nest upon its upper surface. The nest covered with lichens itself, so closely resembles the limb that it cannot be distinguished from a natural protuberance. The nest is very beautiful; it is cup-shaped, and perfectly hemispherical. The periphery of the structure is composed of fine root fibres, lichens and cobwebs. The outside is formed entirely of a coating of mosses and lichens, glued together and to the materials of the nest by the saliva of the bird. Its diameter is three inches, and height an inch and a half. The cavity is one inch deep, and has a diameter at the rim of two and a half inches. The eggs are four, rich cream color with a handsome wreath of blended purple, lilac and reddish brown spots around the larger end. These spots are large and confluent. The size of the egg is .78 of an inch long and .55 of an inch wide. They have only one brood in a season, which is hatched about the middle of June and leave the nest in July. The period of incubation is 14 days. The song of the Wood Pewee resembles the words: peto way, peto way, pee way, uttered in a feeble, plaintive tone. It is very much attached to its young, and boldly attacks man, bird or beast approaching its treasures.

The Wood Pewee occurs abundantly in summer from Mexico to New Brunswick and from the Atlantic ocean to the great central plains. It is also found in Mexico, Cuba, Costa Rica and Guatemala. It breeds from Texas to the most northern limits of its range. It has been taken at Fort William on the north shore of Lake Superior, and on the Red River of the North on the northern boundary of Minnesota. In South Carolina it is resident from the middle of April to the middle of October. It is said that some of them spend the winter in Louisiana and Florida. The call note of this bird is a low, prolonged whistle. Its song is continued through the entire season. During its watch for insects it occasionally utters a low twitter, with a quivering movement of the wings and tail.

The Wood Pewee devours great quantities of small beetles, moths, millers and other insects, and is of incalculable benefit to the husbandman, gardener and florist. The manner of its capture of insects is similar to that pursued by all fly-catchers. It sits upon some dead branch and watches, occasionally warbling its few mellow notes, until it sees a passing insect, when it sweeps out after its prey, sometimes after a single individual, which it seizes with a peculiar snap of its bill; but freqently meeting insect after insect, a continual snapping

EGG OF PURPLE MARTIN.—*Natural Size.*



EGG OF BARN SWALLOW.—*Natural Size.*

sound is kept up as it passes on, until it finally returns to its former perch resume its watch. In this insect pursuit it is wonderfully expert.

Sometimes the nest of this species is placed between the forks of a tw and not invariably confined to dead wood, but is placed occasionally betwe living branches, and is sometimes lined with strips of bark, roots, tow and we pressed together by the bird and coated outside with blue-gray lichens, such grow on the trunks of trees and old fence rails. In all cases the nest of Wood Pewee is one of the most elegant and beautiful of the many fine ha tations constructed by our birds—rivaling the tiny humming bird's pretty n in beauty of finish and elegance of structure. When built upon the upper s of a branch, as first described, the bottom of the nest is frequently so thin t when taken off from its perch it resembles a fine sieve or network and is f tened to correspond to the limb to which it is attached. The eggs also very beautiful in shape and color.

DESCRIPTION.

In this species the tarsus is very short and stout, being shorter than middle toe, scarcely longer than the hind toe, less than the culmen or top ri of the bill. Tail moderately forked. Wings long and pointed, reaching o two-thirds of the tail. First primary shorter than the fourth. Second w quill longest. Third a little shorter. The fourth quill is about .40 of an in longer than the fifth. The longest primary is more than an inch longer tl the secondaries. Head moderately crested. Rictal bristles half as long as l The bill is broad at the base, triangular, wider than half the culmen, somew depressed and flattened, abruptly decurved and notched at the tip, with lo bristles along the gape. The commissure is straight to near the notch, gon slightly convex, nostrils oval, in the anterior extremity of the short, wide s shallow nasal groove, partly concealed by long bristles which extend from posterior angle of the jaws along the base of the bill, becoming smaller, reaching nearly to the medium line of the forehead. These basal bristles ha lateral branches at the base, similar bristles mixed with the loral and c feathers. Basal joint of middle toe united to that of outer toe, but more tl half free on the inner side.

COLORS.

The Wood Pewee flycatcher is six inches long and ten inches in spread wings. The entire upper parts, sides of the head and neck, and the breast dark olivaceous-brown; the breast a little paler; the head darker. A narr white ring encircles the eye. The crest is brownish-black. The lower pa are pale yellowish—deepest upon the abdomen. Across the breast is an as tinge. This pale ash sometimes occupies the entire breast, and even occasi ally extends up to the chin. It is also frequently glossed with olivaceo Wings and tail dark brown. Greater and middle wing coverts tipped w white, forming two narrow bands across the wings. Outer edge of the f

primary and of all the secondaries and tertials, dull white. Tail feathers widening at the ends, margined with the color of the back, the outer one scarcely lighter. Upper mandible black; lower yellow, brown at the tip; legs and feet black; iris hazel. Wing, carpal joint end longest; primary, $3\frac{1}{2}$ inches. Tail, longest feather 3 inches; culmen, 67-100ths. Tarsus, $\frac{1}{2}$ inch.

"THE CONFLICT BETWEEN RELIGION AND SCIENCE."

BY IRA C. BILLMAN, A.M.

It often happens that differences are made possible by putting over on to words strained and unnatural meanings. In a discussion of so much importance as the present an exact terminology is inestimable. Applying the plummet and the square, in the way of a proper definition of its members, we will, doubtless, find this question greatly helped if not wholly relieved of its embarrassment. For the popular meaning of words we need be at no pains. They lie about us loose. We have but to reach out our hands and take them for our use. Thus, religion is from the Latin word *religo*, to bind. Popularly it comprehends theology as a system of doctrines or principles, which are the foundation of a practical piety, contemplating the union of the human subject with his divine lawgiver.

Science is from the Latin *scio*, to know. In a general sense it means certain knowledge—the understanding of truth or fact by the intellect. Thus, more particularly, it is a collection of the common principles or leading truths, relating to any subject, arranged in systematic order.

This popular definition gives us possibility for the science of chemistry, the science of metaphysics, or, just as well, the science of religion. Now it amounts to the same thing, in this sense, to talk about "the conflict of science and religion" as the conflict of science and chemistry, or the conflict of science and metaphysics. Unquestionably there cannot be war between terms of such different nature. Quantities and qualities never so collide. Methods and things ensphered for different destinies never cross each other's orbits in such way as to contend for the occupancy of the same point in space. By that form of logic most consistent with the terminology used it is a *reductio ad absurdum*. Now this should answer all the purposes of what is called "popular science."

But there is a demand for science that is absolutely sure-footed. Popular definitions will not, therefore, always answer scientific purposes; and never when the field is contested. Every inch of advance must then be made in the face of stubborn resistance. Unquestionable facts must be driven to their sockets in the bed-rock of eternal truth, beyond the power of dislocation. What we have said is an index of what we intend to say from a different standpoint. It will, therefore, be helpful to the farther discussion.

The word *science* has come to be used for about anything in relatio knowledge. Now it is confounded with philosophy, which is an investiga of the causes of all phenomena of mind and matter. It is used sometime wisdom, the right use or exercise of knowledge. It is, also, used for invest tion, the high and accurate inquiry after knowledge. And so all the re round about the truth in thecase is pre-empted, till it is difficult to get so m as ground anywhere near the right place on which to set one's foot. Such va is fatal to all science. A real scientific habit of thought always demands ex ness, confirmation and certainty. The offence committed by a scientific i in using words ambiguously, in assuming things to be true which are not pro or in becoming an advocate for a theory he wishes to establish by one-si statement of facts, cannot be forgiven. Scientifically speaking, "it is the pardonable sin."

Out of this *jungle of uncertainty* science must be brought. If by no o means, the sleuth-hounds of an inexorable irony must be loosed on its until overtaken and remanded to its cell under irons, that we may always k when we have need of it, where it is to be found. Without this, discussio utterly useless. If the term science mean one thing to me, and another t to a hundred different men, nothing can be reached by it with certainty. this be done? Has the word science a legitimate meaning sufficiently cur to frown down everything else that is spurious?

As we have seen, science literally means knowledge, but has come to de a systematic and orderly arrangement of knowledge. We may, there appropriately speak of reducing any tangible subject to science. In a r distinctive sense science embraces all branches of knowledge which give tive statements of any truth as founded in the nature of things by observa and experiment. Thus all true science must embrace in a comprehensio its subject both its ultimate principle and necessary law. To pursue sci aright is to take some necessary truth and with it bind up all the appertai facts in systematic order. Where the necessary and universal law for the cannot be attained, the facts of experience and observation cannot yet be jected to science; and the whole subject waits for its philosopher, as the m ments of the solar system long waited for the coming of Newton.

No science can be made of mere facts. They are but its elements, must be held in combination by some principle which conditions the fac be, and to be just as they are. But if the law itself, as in Newton's case, been distinctly apprehended by the verification of a single fact, so sure as so sure all other facts must be; and this is *science*.

Thus it is seen that in order to the completion of actual science there be both the law and the facts—the material and the maker. If the mat cannot be found the law or plan cannot be carried out in the building, a the material or facts are at hand they cannot still be the house until intellig put together by the maker. Now this presupposes, on the part of the bui an idea and material of his own with which to begin. He must then so us

material in the line of his *idea* that it will fall into harmony with the pre-existent law of nature, else his structure will fall to pieces. No subtlest workmanship of fairy hand can, with the idea and material, lay the beams of a chamber unsupported in mid-air; law forbids it. It enacts foundations. Thus there must be the correlative of idea and law in the use of the appertaining material. This is actual science. A failure in any one of these measures lames the system; but where all conspire not Jove himself the work can overthrow. Put to this infallible test, Darwin's idea of "a survival of the fittest," however it may seem to correlate with the recognized law of evolution, while unsupported by a single fact in the line of one species having propagated another, is without material; and therefore exists only as a notion and not a science. Until, then, the first verifiable fact is discovered all the ado of the Darwinian school is sheerest nescience.

We repeat, there must be an invariable standard by which to test science, or else every hypothesis announced by every school, and, eventually, every scholar in every school, lecture, book, will be making what is blindly claimed as science; and so every ones science will differ from everybody else's science. If there be no possibility of determining just what science is—if it has no capable footing—it is not competent to be as a permanent and actual thing, and so is not science.

But this is not the case. We are able to verify our experience in consciousness. This is knowledge. And the facts thus verified, carried back to a law binding them together in systematic unity; or, having the idea, applying which to the facts themselves, we find them so grouping together, by a formative principle, into one intelligent whole as to form its exact counterpart, showing clearly that there is within them an actual law. We are thus certified at every step. The law thus found, as the exact correlate of the idea, will stand by us forever, enabling us completely to explain our knowledge of all the facts and their appearances in hand, or that may in the future be discovered in the same field. This, and this only, is in any proper sense *science.* If it be anything short of this it is a myth, unbecoming the attention of grave and reverend seniors.

Thus it is seen that science has to deal only with the actual facts of obser vation and experience. It exists for the purpose of putting its methodizing hands on all possible verities within its reach, and moulding them into their divine and eternal order. It gathers up all possible knowledge of the celestial bodies, in their observed and recorded facts, and by certain known laws, established by the verification of pre-existent ideas, determines what must be their magnitudes, motions, distances, periods of revolution, eclipses and order—calculates with certainty where a star must pass that never yet has been seen; weighs worlds that are far out of sight, and settles the fact that as yet only the border-land has been trod of an infinite world-populated space. And this unfinished task it has justly called "the science of astronomy."

In the same way "star-eyed science" is competent to gather up all verifi-

able facts of observation and experience in regard to religion, and "their n is legion," from all races and conditions of men. Whatever religion be, he matter of knowledge, and by precisely the same process as in astronc chemistry, meteorology, it must construct the science of religion. If sci be divine it can manifest no partiality. More, carrying along with it the of science—the correlation of idea and law—it will know when it is done such a science has truly been constructed.

It is no insuperable obstacle in the way, that all the facts, or that very comparatively may be brought within the range of its f rthest-reaching ler It was, and is still so, of astronomy. The *one fact*, in the fall of an apple, sufficient for Newton to construct a science. But it is objected, that the un of religion is made necessary by faith. In this again, there is no difference f astronomy. A million unseen things are accepted, because it is verified must be, by the scientific use of known facts. This is just what religion dem and no more. "Faith is the evidence of things not seen." The assertion it deals with the intellect in any unique way, is a confession of ignorance.

While this is in some sense a new field for scientific research—the co tion and classification of all verifiable facts—it is nevertheless a large and fi ful one, and as sure to realize a reliable science as any one already occu In evidence of this claim, one of the leading scientists of the age has alr published a work entitled "*The Science of Religion.*" Prof. Max Muller s "I know that I shall have to meet determined antagonists, who will deny possibility of a scientific treatment of religion, as they denied the possibilit a scientific treatment of language."

But here, now that religion is fairly in the field, what are its true bou ries? Few words have been used by professedly scientific men in more scientific way. It must in this use, mean one of two very different thi Either it is a body of doctrines constituting the faith of Jew, Christia Hindu: or, a faculty independent of and before any form of religion. In former loose way of speaking a man may change his religion. But, in the la we have a permanent quality—the faculty which makes and is religion. W out such faculty no *expression* of religion in Jewish, Christian or varied p way, would be possible. It is not possible therefore in the brute.

Now, as universal man is possessed of such faculty, it is clear that faculty and its motions from within, and not what has been attempted as vision for it without, is the true field of science. The former in all cases is province of science; the latter is that of art, be it culinary or æsthetic.

Here, in order that there may be no gap, it is important to show that s a faculty is clearly recognized by the best mental analysis. The German tem, upon which the best psychology of England and America is based, reso the intellect into: *sinne*, sense; *verstand*, understanding; and *vernuft*, rea The *sense* perceives all phenomena as constructed, but disconnected obj The *understanding* thinks about them, and joins them together as cause

effect. The sense sees stars in the brook and in the sky. The understanding, running along beneath, connects the stars reflected in the brook with the stars that shine in the sky. Thus the understanding is the logical faculty. The *reason* is beyond and larger than these two former—is their overseer. It comprehends both the conceptions of sense, and the judgments of understanding, overlooking the very processes of both. The animal has sense and perceives, and has also understanding and thinks of the relations of what is perceived; but it is only as man is rational, that he can subject both the things perceived and thought to an *apriori* examination. The animal merely *knows;* it cannot tell *why*. But man goes beyond and *knows his very way of knowing*. By the reason he apprehends the truth of all axioms by *an immediate beholding*. The *sense* does not perceive them. The *understanding* does not demonstrate them. The *reason* apprehends or intuitively affirms them. It says "Now I see," of something not subject to the senses and out of the reach of the understanding, and hence, as faculty, is necessary in any complete analysis of the intellect. It becomes science, therefore, to subject the reasons to its methods as surely as other functions. But as this is the faculty of religion—that makes obedience to God possible—by which God himself says, "Come now, let us reason together," "which is your reasonable service;" it is in the same field and involves "The Science of Religion." Any one must see, if the sense with its impressions, the understanding with its logic, are matters of science; so must be the reason with its beholdings. "As it is the legitimate ground of science to explain what is, not what ought to be, there will be, and can be no rest till we admit what cannot be denied, that there is in man a third faculty, which I will simply call the faculty of apprehending the Infinite, not only in religion, but in all things."*

It is not true, therefore, that science and scientific men, as such, have nothing to do with religion; or, that "they have need to mind their own business and let religion alone." For if there be any possible observations and experiences of religion verifiable as facts, they are within the legitimate scope of science, and science can never stay until it has demonstrated that there is not such a single fact. But the truth is, no field pertaining to the human race is so fertile in *history* and, therefore, in facts, as religion; and, therefore, we shall have a competent science of religion. It is coming. And science, sweeping the rounds of all historical faiths, must drop out as incumbrances, all expressions and forms of religion, not grounded in the verifiable facts of the religious faculty itself. This will not be all gain on the part of any existing mode of religion; but its finger will point in such unerring way toward the pole star of "*The Absolute Religion*," as to be of immeasurable gain. And it can be done. The fact, that going on before all science of astronomy, there were astrological books and traditions in the hands of magicians making it difficult to overcome prejudice, did not prevent the realization of a science of astronomy.

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* Max Muller. Science of Religion, p. 14.

Religion, like the stars, existed before science and is competent to without it, only that it is needlessly burdened and hindered in its effici and so it waits for the science of the intellect for which it was made, to upon a law that shall bind all valuable facts into correlation and reject al is spurious as rubbish. It will no more do to protest against the condu such a science, than for Pharisee to protest against the use of the Sabbath. spiritual end was liberty for man, and any thing that would let loose a mai keeping it. So everything that favors a law of man's spiritual w ness must have its course over all prejudices in the way of their scientific er the interest of the religion that was made for man and not the man tha made for religion. Such a clearing and classification is not of the natu collision, any more than that Christ and the Sabbath were or could l conflict.

It is now apparent that there has been and never can be, any "co between religion and science." They are not of a nature to collide. I loose and unscientific way of speaking, which the use of abstract terms n possible to every man, whether or not possessed of definite ideas in relati the mind's working, other conflicts have taken the name. Conflicts ther between the speculations of some scientific men and the convictions of religious men—between the traditions of old, fosilized churches and hale, g ing science; as Draper has shown in his misnamed book. What if scienc theology is in conflict? That still means something different from reli Religion is eternal faculty—theology is a variable product, that has chan thousand times in shades and forms in as many years. Religion itself i responsible for these abnormities. No more is the sacred institution of riage. As well talk of conflict between marriage and nature.

Or if you will, there are conflicts between certain Biblical statements the testimony of the rocks. But the Bible even is one thing and rel another. No one ever need try to believe a statement any where at vari with conscientious reason. For religion is bigger than all tradition, was b the Bible; in the first man and woman ever made. Thus between religion science, each legitimately used, there never has been and can be no con any more than there ever has been a conflict, properly speaking, between sci and the stars.

This is an important consideration; for even Prof. Max Muller lays self open to the charge of technical inaccuracy: not in relation to the upon which we have shown by quotations he is perfectly transparent, but i use of terms. Again and again, he confounds the sense with the understan and this with the reason—perceiving with thinking, and this with apprehen and variously. He says: "This third faculty is a power independent of and reason, a power in a certain sense contradicted by sense and reason."*

But reason is itself the third faculty of which, according to the sense c

* Max Muller. Science of Religion, p. 14.

discussion by a sound psychology, he is speaking, he having used it for the second, which is understanding.

Thus rises the final question, Does one faculty contradict another—the reason contradict the understanding? Hume taught that reason flatly contradicted common sense. But his argument from common sense was simply the conviction of consciousness, which he alleged was contradicted by reason; or, in other words, that nature was in conflict with the supernatural. Now this is the condition of things, some literary men imagine, exists between religion and science. It is said that religion only gets on its true basis when it passes beyond what happens and rests upon what forever is, beyond the reach of all its becomings; while science is only on its own ground, searching with powerful analysis and connecting with a discriminating synthesis in eternal and unerring order, what has and is forever happening in nature's processes.

If this even were the true attitude of the terms toward each other, why talk of conflict? In the very condition of things it would be impossible. *Is* and *ought*, are the words that express man's relation to nature and the supernatural. The brute has no duty to perform; it *is*. Now does man's existence in nature conflict at times with obligations to the supernatural? For instance, a desired pleasure is often checked by something in consciousness, but on submitting the case, it is found that there was a mistake in the desire, and that what is for the best as man is for the best as animal. Theology is coming more and more to discard the notion of arbitrary law. Viewed in its proper light, the discord which so troubled Hume, and his followers since, is a conflict between right and wrong, true and false or natural and depraved desire in the animal itself of man. No! Between nature and the supernatural there can be no conflict. Wind may beat against wind in mighty whirlwind; storm collide with forest and mountain; but this is all nature in conflict with nature—the earth with the earthy, that it can reach. And yet above the mightiest storm that ever strode sea or land in robes of mantled fury and darkness, the stars shone on just as bright as when all was peace below.

The assertion invites a thought, however, that must not be overlooked. It is contended that we may know nature, but that the supernatural is "the unknowable." Now, in order to know if they collide, we must not only know all the relations of nature, but also the relations of the supernatural. For, I can never know, if what I do know, does or does not collide with what I do not know. If it still be contended there is sensible collision, then the answer is, until you show me the supernatural, or admit that it is knowable, I will contend justly that it is not a conflict of nature with the *super*natural—it may be the *infra*-natural. Knowing the knowable, we know its attitudes and hostilities, but by argument, not knowing the unknowable, we can never tell if the two are in conflict, and that it is not something else. But this whole line of argument is unsound. It proceeds on the assumption that nature and the supernatural are forever estranged. That as nature cannot possibly get up into the supernatural, therefore the supernatural connot get down into nature. But the veri-

fiable facts, are scientific answer. That by the first creation : when, wher how it was done; a spirit was put into a sensuous, animal, organic body an into nature, is all the warrant one needs that there is room for any miracle economy of nature may require. For, if nature could take soul or spirit, wl is the supernatural at the first, at some one time or oftener according to origin of the race, it can always take it on, and suffer neither in law or ord violate neither the one nor disturb the other. We are, therefore, fully satis that there is a possibility of settling forever the question under discussion, l careful attention to the technical use of scientific terms, in such a way th shall no longer be a conflict of words without knowledge, instead of a con between religion and science.

MARINE CAVES.

In the Tonga Archipelago, on the island of Hemga, is a very large beautiful submarine cavern, the entrance to which is entirely hid beneath surface of the sea, even at low water, and can only be entered by diving. W one has attained access to this splendid temple by diving and arising int hollow recesses, a view of magnificence and grandeur is disclosed, to wl words fail to do justice. Once inside, some distance from the entrance floor rises so that one can emerge from the water and walk upon dry grou No light can enter the cavernous chambers of this marine temple except thro the great mass of water at its mouth, fully 100 feet thick. The light thus p ing through such an immense thickness of water irradiates the whole cav with an intense and beautiful blue light. All the light being reflected from sea beneath, gives a strange, weird aspect to surrounding objects. The n apartment branches off on one side into two smaller cavities. This main r is about 40 feet wide; the ceiling is arched and about 40 feet above the sur of the water. It is adorned with many beautiful and remarkable stalacti some of which reach the floor, forming pillars of great beauty and elegance.

There is a story connected with this cavern to the effect that the chief first discovered this wonderful ocean grotto kept the secret to himself, an its only entrance is hid beneath the waves, this was not difficult—using it place of refuge for his wife, to screen her from the persecutions of the reig sovereign. The sea faithfully guarded his secret, and here, hid beneath ocean surges, they safely and happily passed many weeks in peaceful seclus until finally they fled, at an opportune moment, to the Feejee Islands; and on return with his beloved to his native home, after the death of the tyrant, countrymen heard with extreme astonishment of the wonderful and beaut azure cavern beneath the waters of the ocean that had so long concealed protected his treasure.

One who once visited this natural curiosity, says that he was one day out rat-hunting with the king and his followers, when finally the king and all his retinue were seen to dive beneath the waters and disappear. The gentleman who relates the story, says that in astonishment he asked one of the last of the followers of the king, just as he was about to dive and disappear, after the rest, what they were about to do. He answered that the king desired to take his repast in the cave. So, following his guide, he too dived, and swimming behind his friend he finally emerged into the cave; and, hearing voices, he still following his guide, finally arrived at a projecting ledge where the assembled company were at their repast. This was probably the first white man who ever penetrated into the cavern.

On the island of Sardinia, in the Mediterranean Sea, is another remarkable submarine cave, called Antro di Netterno. This cavern is twelve miles from the town of Alghero. It is very difficult of access, for any wind between the northwest and south prevents an entry, so that the natives assert that on 300 out of the 365 days of the year, it is impossible to enter the cave. The first vaulted cavern forms an ante-chamber about 30 feet high, and has no particular attractions; but on crossing a second chamber, which contains wonderfully clear water, and turning to the left, we pass through an intricate and difficult navigation between pillars and columns of stalagmites, with surrounding walls and passages between them of considerable height. Having passed these, and proceeding west, the traveler reaches another arched and vaulted chamber with a large column in its center, the shaft and capital of which supports the immense and exquisitely beautiful fretted roof. There it stands in the center of this stupendous chamber alone in its grandeur, with few other stalagmites to destroy the effect of its solitude.

Besides these described rooms there are grottos, corriders and galleries, some of them 300 and 400 feet long. One of them terminates in a deep cavern, into which no one has yet been able to penetrate. But one of the chief attractions to this beautiful and wonderful cave is a small chamber, the access to which is through a very narrow aperture. After climbing and scrambling through this passageway, one finds himself in a room whose ceiling is entirely covered with beautiful and varied stalactites of the most delicate structure, and the sides with exquisite fretted open work, so delicate and fantastical that one easily imagines it to be the most elegant lace work of beautiful design hung upon the walls, and of the purest white. Some of the columns in this cave are from 70 to 80 feet in circumference, and from them in various chambers masses of drapery hang in graceful festoons of the most delicate open work of equally grand proportions with the columns themselves.—*Hartwig.*

THE NORTHERN HARELD.

When the sweet, warm, joyous days of summer have departed, and cheerless suns and chilly blasts of winter have returned again, then away u some desolate, shingly Scottish sea-shore, may frequently be discerned duck-like form and aspect of the Northern Hareld. He is a recently-arri visitor from the Arctic seas, where his long summer sojourn was spent, wher experienced the delights and love of parentage, and from whence the increa violence of the northern blasts and the prevalence of frost-bound seas ruthle expelled him. His steps are not alone in these dismal haunts; for a vast c gregation of sea-fowl, ranged along the wave-washed shore, perpetually awa the echoes thereof with many calls and exclamations. Cheering and exhila ing indeed it is to hear the sounds as they float upon the breeze; for the b contrive somehow to sustain an extraordinary amount of chattering and qua ing. They sing out strange sounds which the syllables ogh, ough, egh, fairly represent to human ears, in a ludicrous, drawling tone for hours at a ti

Nevertheless, while the main body is in the course of its migratory ex sion from these northern latitudes, there are occasionally to be found s stragglers therefrom, wandering about at random, mid trackless ways and d late shores. Some individuals, more dilatory, or less capable of using t instruments of flight than the rest, are left behind, and losing their way, ali well-nigh spent with their exertions, upon some desolate coast, far remo from the seat of their congeners. These straggling specimens, however, do occur frequently, nor do they roam to any extensive distances from the h quarters of their species. The northern coasts of England and the soutl coasts of Scotland appear to be the boundary of their southern range; as more southerly latitude than this, exceedingly few or no specimens at all h ever greeted the gaze of the most persevering and energetic sea-fowler.

Far away among the inland lakes of Lapland, Sweden, Norway, Icel etc., the Northern Hareld fixes his summer seat. In the New World, too, a amid the vast congregation of snow-clad islands and ice-studded sea densely throng the polar regions, our adventurous Arctic voyagers have quently encountered the wonted haunts of this supremely interesting bird. coast of Baffin's Bay, Melville Peninsula, Boothia, Labrador, etc., are the loc ties which have been specially notified as the breeding-stations thereof. Ab the seventy-fourth degree of north latitude would appear, therefore, to be extreme limit of the northern summer range; so that it is evident that the c poreal constitutions of these sea-birds are competent to withstand the rigou a very considerable degree of cold. This conjecture is fortified by the circ stance that they are among the last of the migratory sea-birds to abandon t summer domicile. Early in October, the various elevated mounds which oc in these dreary regions, such as ice pinnacles, iceberg crags, etc., are obser to be profusely studded with a countless multitude of noisy sea-fowl. shores ring again with the hideous clamor; but presently there occurs a gen

stampede among the living mass. Flocks and flocks in rapid succession rise majestically into the air, and fly off with fresh and rapid strokes in a southerly direction.

The frequenters of the inland lakes of Norway, Lapland, etc., and perhaps Iceland, careering in a south-westerly or south-easterly direction, encounter in their passage groups of outlying islands (the Orkneys, Shetlands, and Hebrides), or more extensive patches of ground (the coasts of Sutherland, Caithness, etc.), and feeling satisfied with the temperature of the atmosphere there prevalent, and the general aspect of the locality, forthwith alight, and prepare for the winter campaign. The Northern Hareld is thus a mere winter visitant to our shores, as distinguished from a permanent resident thereon; and thuswise has he come to be styled *glacialis*.

Supreme gracefulness and agility are the characteristics of the swimming and diving movements of this bird. The body is of an oblong, yacht-like shape, the tarsi are comparatively short, and the feet, although admirably adapted for propelling the bird whilst swimming, are not situated so far backwards as in the Colymbidæ, and so enable tolerably steady walking movements to be accomplished. The Northern Hareld, in short, is a duck as distinguished from a goose, and consequently possesses all the well-known characteristics thereof. Unlike the latter tribe of Natatores, the operation of diving on the part of our bird constitutes a fundamental and important method of acquiring sustenance for itself, and of fulfilling those functions which it is appointed to discharge in the animal economy of nature. This circumstance is apparent from the fact that the ribs of the bird are elongated, and the bones of the sternum extended so far beneath the body as to obviate any injury that may accrue from a too extensive exposure of the softer portions of the body—the stomach an intestines. Thus in diving or swimming, the bird might possibly graze some concealed projecting piece of rock, or other matter, which might occasion serious if not fatal injury to the vital parts, if they were not somehow protected from such contingencies.

Marine productions of all kinds, both animal and vegetable, constitute the victuals of the species of duck now under review. An especial predilection, however, is manifested for the nutritive or palatable qualities of the Zostera, or grass-wrack. This is a long, narrow, rush-like species of sea-weed which spreads itself in green meadows along the sandy bottom of shallow creeks or other pieces of water. It may be mentioned that the tongue in this bird, as in most ducks, is large, thick, and fleshy; the œsophagus is very flexible, and capable of great dilatation; the stomach is a strong, muscular gizzard, and the evecal appendages comparatively short, measuring only about three inches. These facts would seem to indicate a very extensive endowment of digestive and assimilative powers, ancillary no doubt to the riotous luxuriance of animal spirits and the superior diving and swimming powers exhibited by the bird. The bill, moreover, is strong, elevated at the base, and provided at the extremity with a large notched hook, or nail. The laminæ, or "teeth," are powerful, and

apparently adapted, in conjunction with the nail, not so much (as in many o Anatidæ) for straining the water from the solid nutritive particles containe the mouth, as for seizing and separating pieces of fleshy or other matter. deed, the peculiar form and structure of the bill and lamellæ exhibited by Northern Hareld may be observed to gradually augment in perfection adaptation to the purpose now specified, as we advance through the scot eiders, and mergansers, and arrive at the Colymbidæ—birds which subsist clusively upon fish.

In recounting the generic characteristics of the Northern Hareld, or lo tailed duck (*Harelda glacialis*), we must carefully distinguish it from its c geners the gannets (*Clangula*) on one side, and the scoters (*Œdemia*) on other. From the former, it is principally distinguished by the immense c parative development of the tertial and tail-feathers; from the latter it is n easily discriminated by the much smaller, lighter, and more graceful form structure of the body, and the lighter colors of the plumage. The bill of genus Harelda is short, elevated at the base, and bears a large nail, and str conspicuous lamellæ; the nostrils are basal and linear; the wings are acumin with very long scapulars and tertials; the tarsi are short, and bear a lo hallux; and a couple of the tail-feathers are much elongated comparatively v the others.

In the enumeration of the specific characters of the bird now under rev we must carefully distinguish it as it appears in the young state, or in the s mer or winter season of the year. In the young state, the scapulars and t feathers are not particularly elongated; the neck and breast are partially wh and bear no trace of the broad band which subsequently appears; and back and wings are of a lightish-brown color.

In the winter plumage, we observe the top of the head, neck, upper par the breast and back, belly, vent and scapulary feathers are pure white. each side of the neck there is a large patch of brown; the lower part of back, rump, tail, and wings are brownish black; the bill is black, and the and legs yellowish grey. The total length, including the long tail-feather about twenty inches.

The summer or breeding apparel of this bird is characterized by the foll ing marks: The whole upper plumage, the two central pair of tail-feath and the under plumage to the fore part of the belly brownish black, the les quills paler. A triangular patch of the feathers between the shoulders, and scapulars, broadly bordered with orange-brown. Sides of the head from bill to the iris ashy-grey; eye-stripe and posterior under-plumage pure wh Flanks, sides of the rump, and lateral tail-feathers white stained with bro axillaries and inner wing-coverts clove-brown. Bill black, with an orange l before the nostrils; legs dark brown.

Having now specified the general characteristic features of the North Hareld, let us briefly advert to two special peculiarities that may be rea

observed in the contemplation of the structure, form, and habits of this beauteous sea-bird.

In the first place, the extraordinary development of the tertial and tail-feathers is worthy of special comment. The tertial feathers, it is well known, are an outgrowth of the humerus, or great arm bone—a part of the volatile apparatus whereto the pectoral muscles which elevate and depress the wings are respectively attached. The tail consists of fourteen feathers, the two central ones whereof are remarkably elongated. The special purpose or purposes intended to be compassed by these feather developments are not very obvious. Their relations to flying or diving excellence are not easily discovered; for in those birds which specially excel in these accomplishments we observe lengthy primaries (as in the petrels and frigate-birds) rather than lengthy tertiaries; while in the great diving family (the Colymbidæ) the tail is invariably short and rounded. Most probably some ornamenting purposes in connection with sexual relations are intended to be subserved in the case now before us by these rare and beauteous feather developments. We may observe also, with regard to this point, that the flight of the bird exhibits the qualities of strengh, steadiness, and endurance, rather than those of ease, swiftness, or gracefulness.

In the second place, the extraordinary variation in respect of color exhibited by the summer and winter apparel of the duck demands our minute observance. The complete moult occurs about the month of October, and for some time thereafter the coloring of the feathers is that which we have already indicated as distinctive of the winter plumage of the bird. In the spring there occurs a second partial moult, and a certain portion of new feathers seems to be superadded on that occasion, though not, perhaps, sufficiently extensive or numerous to furnish an explanation of the wondrous change of color which is then perceptible. It would appear, therefore, that certain of the feathers change in color at the vernal season. The change commences at the point of the vane nearest the skin, and gradually extends outwards until the whole or the greater portion of the entire feather is tinged with the new feather. Thus the plumage of the upper part of the breast, which is pure white in winter, is transformed, on the approach of the breeding season, into a brownish-black color.

It has lately been advanced that the brightness and fading of the colors of feathers are due to the presence of an oily matter, which conveys its particular red, or black, or whatever color it happens to be, to the particular feather which it pervades. It may not, perhaps, be very easy to determine how this oily secretion is exhibited at all, or from what quarter it proceeds. When the feathers are first formed, they are living, vascular parts, and perhaps when they are at that stage of their development, some liquid matter is evolved out of the blood, which, inserting itself into the non-vascular portion of the feather, gradually works its way up to the extremity thereof, and in this manner communicates its particular hue to the shaft and webs. At the moulting season there is such a prodigality of life-energy (so to speak), the vital processes are

conducted with such energy and alacrity, that ample scope and opportunity furnished for the development of forms and colors which, though insidious, indispensably necessary ingredients in the animal economy of the bir *By P. Q. Keegan, LL.D., in Animal World.*

A TRUE STORY OF A DOG.

Long ago, in a house in a far-off town, which an iron-handed industry since made all her own, begriming the once pleasant fields, thickening the c stream, and driving the birds who sang by it and the woods which shelt them further and further back, while she grinds and clangs away incessantl the tune of pounds, shillings, and pence, a little child was one day left knowingly to her own devices. Her mother and the two handmaids formed that small household were intent on some domestic business and thou her safely bestowed. This little maid, however, in the meantime determi on improving her acquaintance with the fire—that charming and wonde element which sent out such pleasant warmth and cheery light in the wi evenings, and made such fantastic shapes to please her in its dying emb that, warned against it though she was, it could not surely but prove a kir playmate. The brilliant treacherous flames soon took advantage of her in cence, and would have formed for her, as for so many other children, a f chariot to the heavens—,—and what child is not the gainer thereby when means but the heartache to so many?—when one of those shining guardian whom children must be especially dear, if only because so like themsel touched with quick instinct of the danger the dumb breast of another guard near, faithful though lowly—a large brindled dog, aptly enough named Kee and chose him for a messenger. The father of the child, about to leave house, saw the dog, bounding and panting, rush up to him and away again v little heed, and a second time approach, again to be unheeded; but whe third time the excited animal appears, seizes his coat, and tries to tell trouble,—feeling that something unusual must have happened, the ma quickly follows him, to find his little girl on fire, and to extinguish the flan That little girl, this long time grown a woman, yet remembers dimly, as tells the writer of this anecdote, crying over the pain of the daily dressing her burns, has another dim remembrance of a large dog running at her side, a lively one of the tradition in her family. What wonder that, with a heart of compassion to all God's creatures, she has ever felt a special fondness the race of her preserver, and hailed with gratitude the first efforts to find ho and shelter, or, if needs must, a speedy end to pain for those poor waifs strays who used to be so common in our streets, and whose pleading eyes sp the more because they have no outlet in language, nor, except by such servi as that here recorded,—and recorded, let me add, in how many instances e where!—can acknowledge our kindness in more substantial fashion than some dog-lover has expressed it, a wag of tail.—*Giovannina, in Animal Wo*

A MARINE FOUNTAIN.

Near Huatulco, a Mexican village on the Pacific coast, a large shaped mass of rock runs out into the sea from the mainland, to which i joined by a narrow strip of rocks. The constant beat of the sea swell, rolls in with tremendous force, has undermined and worn away the face of rock in every direction, so that its wall presents numerous caverns and bers, until it presents the appearance of a gothic building with many In the center of this rock, the water rushing into the subterraneous and hollow caverns beneath, and finding no way of egress, has worn two passages vertically upwards. These are perfectly smooth and cylindrical, as if cut by tools. When a sea rolls in, the waters of course fill in an instant the hollow caverns inside the rock, and finding no other way out, it rushes up these funnels and flies roaring furiously, to a height of full 150 feet. The instant the wave recedes the vacuum beneath causes the air to rush into the two apartures with a loud thundering sound, which is heard at a great distance. This stupendous fountain renews itself whenever a breaker rolls in against the rocks. The noise of this magnificent jet of water is heard at the distance of three or four miles, and the spray from the fountain falls in myriads of gems all over the rock from which it springs.—*The Sea; Hartwig.*

THE STUDY OF NATURE.

The true student of nature should have an all-absorbing and unconquerable love for the pursuit. He should also have an impregnable love for truth—the faculty which impels and prompts a critical investigation of the facts and the laws of nature and all the objects in relation to it. Few things give more gratification than the sense of having overcome the difficulties which beset the naturalist in his studies and researches in the physical world around him. With the nicely-adjusted and extremely accurate instruments now used in making investigations, the modern student of nature is enabled to investigate and analyze the properties of nature with more confidence and greater accuracy than his predecessors. With this, added to the faculties before mentioned, he enters upon his investigations. He doubts every hypothesis and every statement, for the purpose of testing its truth. No fact or statement, no matter by whom advanced, should be taken for granted by the true student of nature until he has proved it to be so by his own careful tests and researches, and not until it has been found to bear the test of the most rigid scrutiny and investigation. He should be most minute, careful and accurate in all his investigations. He should also be very observant and accustomed to note not only the most prominent facts, but those that appear most trivial and commonplace. *No fact* in nature is too trivial to note and record. It is a study that compels the *utmost* exactness, accuracy and minuteness in measurements, details and statements. C.

STAR FISH.

The ocean has its stars as well as the heavens above, nor are these sea s merely the semblance or images of those celestial brilliants which shine sparkle in the azure of the sky, in shape only, for they too shine with their light: not so brilliant or far-reaching, it is true, yet at times the star fish g with a bright phosphorescent light which brings out in the dark the entire f of the animal with distinctness, showing its rays and center as a brilliant glist ng sea light.

Star fish have always been subjects of curiosity, not only on accoun heir shape and color, but also because of this phosphorescent light, and on account of their habits. Who that has wandered along our sea beaches ıot delighted to gather the delicate and curious little five-rayed stars that st he sands.

Star fish occupy a very low rank among the denizens of the sea, yet upc lose inspection their construction, simple as it is, exhibits a wonderful org zation, showing that nature constructs all her works, from the most humbl he highest and most powerful, with care and perfection.

The body of these animals is depressed, or flattened, and always divi into five rays or armes, which taper to an acute point. The upper surfac studded with rough knobs, generally yellowish in color. Between these kn are the openings through which the creature receives water into its body. skin is leathery, and contains the afore-mentioned corpuscles, "beneath wl is a cutaneous skeleton of porus, calcareous pieces, movably articulated, extended on the lower surface from the mouth in the center of the anima the extreme end of the rays. In the lacunæ between these pieces are the am lacral pores along the center of the lower surface of each ray, through wl are protruded the ambulacracal tubes," or feet, by which the star fish w These are arranged in a double or quadruple row, and are provided with tractile sacs or vesicles on the inner surface of the envelopes. The tubes ar constant motion, each ending in a suctional disk, and pull the animal alon by the successive action of so many little anchors." "On the external edge the rays are a series of stiff spines, probably serving for protection, and at end of each ray is a small red spot or eye." There are also scattered over upper surface small processes, ending in calcareous hooks or pincers." mouth is in the center of the animal and opens into the cavity of the stom from which branching tubes extend to the outer extremity of each ray. The fish has no tentacles, and the mouth is dilatable, and the stomach can "everted" over the food and then turned back again. Large shell fish taken into the mouth and the soft parts digested, while the shells and indig able portions are ejected. The rays of the star fish can be bent in any di tion at the will of the animal by the contractile skin and muscles.

By the action of cilia, water flows through the body in small tubes, diste

ing and protruding the feet, filling the circular vessel around the mouth and serving for respiration, which is performed partly by the vesicular appendages attached to the central ring. All the viscera are bathed in water, and respiration is also effected by the delicate vessels thereon distributed. The vascular system is simple; the nervous ganglia are five, arranged around the mouth, each sending filaments to the ray at whose base it is situated. The sense of touch is very acute. The power of reproducing lost parts is very great. On the upper side, at one side of the center and between two of the arms, is a bright red spot, the madseporic plate or body communicating with a canal leading to the water vessel around the mouth. This is a sieve, through which water is filtered before it enters the aquiferous system for circulation through the whole body."

Star fish propagate by eggs, which are retained for a time under the body of the parent, who rests on the points of the rays with the body raised in the center, in order, perhaps, to hatch them. The sexes are in separate individuals. The larvæ are at first oval, ciliated bodies, without external organs or distinct parts. From these, which have a bilateral symmetry, the perfect animal is evolved by a process of internal budding. One species, free when adult, is attached to a long and slender stem when young. Another species is only a free floating globular mass when young.

Star fish are very voracious, and devour small fish, mollusks and crustaceans. They are not used as food for man. They abound in every sea, from the equator to the polar regions, and are divided into several groups and many species. In many places the bottom of the ocean is paved with them, so numerous are they.

Among the different groups are the ophinridæ or snake stars, with long, snake-like arms, or rays. They have no suckers and progress by wriggling or twisting their arms. These arms differ from those of the true star fish, which are lobes of the animal's body, in being mere processes attached to the body. These, also, called sand or brittle stars, have the remarkable property of separating themselves into numerous pieces with ease and rapidity, whenever touched or disturbed.

The Solasters, suns, or sun stars, are very handsome, being of brilliant colors. Sometimes the entire upper surface is of a brilliant purple; frequently the disk is bright red or scarlet, and the rays white, tipped with red. They grow often to a considerable size, sometimes being found eleven inches in diameter.

The Goniasters, or cushion stars, are pentagonal in form. They are very thin and flat, and when alive are also extremely flexible, like a piece of soft leather. One species is white, with a red center and five-bright scarlet rays.

The Asteriœ have the property of dividing themselves into separate pieces when disturbed, like the Ophinridæ above described.

One species, the Lūidia Fragilissima, is two feet across when adult. The rays are five times as long as the disk is broad. Its color is brick-red above, and straw color beneath. It is found about the coasts of England.

MINUTE LIFE IN THE OCEAN.

The sea is teeming with life. It is the great reservoir of creation. "I not, reader, that the life of the ocean ends with the innumerable hosts of fi mollusks, crustacea, medusæ and polypus;" and that the waters of the s the sands of the shore have no further marvels for us to admire." "The n eye indeed may have attained the limits of life, but the microscope will reveal a new and wonderful world of animated beings." "Take only, for inst while wandering on the beach, a handful of drift sand and examine it thr a magnifying glass. You will then not seldom find among the coarser grai inorganic silica a number of the most elegant shells," so minute as to b observed by the naked eye, yet of the utmost elegance in shape and formati "some formed like ancient amphoræ, others wound like the nautilus, bu shaped in their minuteness with a perfection which no human artist could to equal in the largest size." "The knowledge of these charming little m productions is of modern date, for they were first observed in the sand o Adriatic by Beccaria in 1731." "The sand of many sea-coasts is so mixed Foraminifera, as they have been called from the openings with which their s are pierced, that they often form no less than half its bulk." "Plancus cou 6,000 in an ounce of sand from the Adriatic, and d'Orbigny reckoned nc than 3,849,000 in a pound of sand from the Antilles. Along the whole Atl coast of the United States, the plummet constantly brings up masses of miniferous shells from a depth of ninety fathoms, so that the vast exte ocean bottom, which itself forms but a small part of the domains they occ is literally covered with their exuviæ."

"Thus their numbers surpass all human conception, nor can any series of beings be compared to them in this respect; not even the minute taceans, which color thousands of square miles on the surface of the sea, according to Scoresby, form almost exclusively the food of the huge Greer whale; nor the infusoria animals of the fresh water, whose shells compose Bilin slate quarries in Bohemia, for these are limited in their distribu whereas the foraminifera occur in all parts of the world."

"The resemblance of the foraminifera to the nautili and ammonites at led naturalists to suppose that they formed part of the same class, which long course of centuries had dwindled down in less congenial seas to al invisible dimensions; but a closer investigation proved them to belong much lower order of beings, nearly related to the amœbœ, which likewise c all over the ocean." "Other animals excite our wonder by their compli structure, but the amœbœ raises our astonishment by the excessive simp of its organization." "The amœbœ is nothing more than a living globu mucus, or transparent colorless contractile substance, or plastic mass, the vidual life of which shows itself in manifold changes of form, bearing character of voluntary motion." "There is absolutely no trace of parti

organs in the amœbœ; all its constituent parts may be used for any purpose—all equally move and digest, and each can at any time perform the organic functions pertaining to the whole."

"In their internal simplicity the foraminifera are on a par with the amœbœ, and differ from them only in respect of their outward form." "The amœbœ are naked, while the foraminifera are covered with a shell, out of which, through one or numerous openings the animal protrudes, the processes which it requires for creeping or seizing its prey. These processes or filaments of mucus frequently ramify, closing as they spread, and sometimes covering an area of several lines in diameter, in the center of which the animal, inclosed in its shell, waits for its prey, like a spider in its net." "The extended filaments appear to have something venomous about them," as small animals, such as colpodes and other infusoria, drop dead as soon as they touch the net.

"The amazing variety of form of the foraminifera is no less remarkable than the elegance of their delicately chiselled shells, and may well be called immense, as no less than 2,400 living and fossil species have already been distinguished by naturalists, and a far greater number is probably still nameless and unknown." Though generally so minute that the diameter of the pores through which they protrude their filaments usually only ranges from 1-3000th to 1-10,000th of an inch, yet the diminutive world of the foraminifera has also its giants, particularly among the fossil (extinct) species, such as the Nummulites, which occur in such prodigious numbers in the limestone of the Egyptian pyramids, and whose flattened lenticular coin-like forms attain the comparatively gigantic diameter of several inches." "Thus the material with which the proud Pharaohs of the Nile constructed their colossal tombs was originally piled up at the bottom of the sea by countless generations of shell-cased protosoa."

"The foraminifera are among the oldest inhabitants of our globe, and as the present ocean contains them in countless multitudes, thus have they swarmed in the waters of the primeval seas from the first dawn of creation, and piled up the monuments of their existence in vast strata of limestone.*

Among the microscopic inhabitants of the sea the polycystina rival the foraminifera in minuteness of size, beauty, elegance and delicacy of structure and prodigious numbers. Some of them resemble delicate and elegant balls covered with spines or slender needle-like protuberances. Their bodies, like the foraminifera, consist of homogeneous viscid and plastic mass, and they are capable of protruding it through perforations in the shell the same as the foraminifera. They have been obtained from the ocean at from 1,000 to 2,000 fathoms, and are equally if not more minute than the foraminifera, and equally contribute to build up the structure of the earth rind.

* The Sea. Hartwig.

ON THE FEASIBILITY OF UNITING THE CYPSELIDÆ A HIRUNDINADÆ.

Perhaps to many ornithologists any argument for the above purpose i seem a step backwards—a return to the primitive, old-fashioned and sim classifications of our forefathers. But I take it that the most *natural*, and the same time most *obvious* and simple arrangement, is practically the best.

All classifications are supposed to be made, not to complicate and ren the study of natural objects intricate and difficult, but to simplify and make investigation of the great multitude of subjects easier. Therefore, instead is too frequently the case with modern systematic writers, of multiplying needlessly increasing the number of primary and subordinate divisions- many instances giving almost every species a separate genus—we should s to simplify the study as much as is consistent with a natural arrangement, making as few divisions as possible by putting all species which in *general* str ture, habits and manners agree, into the same division. There must be sc variation in generic structure, so to speak, and the question is *what are gene* and what are *family* marks of structure. As a broad, wide, and general r first impressions are the best and most correct. Now, any person who has been carried away, or perhaps, if I may so express it, mislead by the "intrica points of structure, he has been lead to adopt—to the neglect of general vivid points of resemblance—will at once place the Chimney Swift and White-Throated Swift in the same general division—call it family, or what may—and in close juxtaposition to the Barn Swallow and others of swallow tribe. Saying that the Swifts, Swallows and Martins are all of a l dred, and should *not* be separated widely by far different birds. I should be understood to imply that the Swift does not belong to a different ger There are certainly marks sufficiently characteristic to warrant this, but I lieve that the Swallows, Swifts and Martins should all be classed together. would make a division—family—perhaps, containing the Caprimulgadie, Hir dinadæ, Cypselidæ and Trochilidæ, in the above order, for they are all clos assimilated in habits and structure. Let us see now upon what grounds mod systematics separate the Hirundinade from the Swifts. They say: 1st, that nostrils are superior instead of lateral; 2d, that the wings have ten instead nine primaries; 3d, the tail has ten instead of twelve feathers; 4th, feet with scutellæ, and 5th, the sternum in the Swifts is plain on its posterior edge not indented as in the Swallows. Now these are all good and sufficient char teristics as far as sub-family distinctions go, but *not* sufficient to separate them fr the Swallows. Let us now see the points in which the two families ag In both the bill is small, triangular, depressed, much broader than high; gape deeply cleft; wings in both very long, the first quill longest; the h flattened and the legs short and weak. In habits they almost exactly agr both spend nearly all their time in the air upon the wing in pursuit of th insect prey, which they capture in their mouth as they fly rapidly in purs

The difference between the Swifts and Swallows are not greater than those between the Humming-birds and Swifts; yet these two last are put in close juxtaposition with *no* genera between them but the families immediately succeeding each other; while fly-catchers, crows, sparrows, larks, finches and orioles are placed between the swallows and swifts. Of course they should be in separate divisions, but why so far apart, and why should they not be classed as kindreds and similar birds, and placed in the same general division, with *no* intervening birds?

The arrangement which seems the most natural is as follows—adopting the old order Strissores until a better one is offered, as the primary division:

STRISSORES.

Bill small, depressed, wider than high, triangular, deeply cleft; wings extremely long, and falcate; legs short, weak; head flat; food, insects, which are captured upon the wing.

FAMILY HIRUNDINADÆ—SWALLOWS.

Primaries, nine; tail feathers, twelve; nostrils, lateral; sternum with openings or emarginations in its posterior end.

FAMILY CYPSELIDÆ—SWIFTS.

Primaries, ten; tail feathers, ten; hind toe more or less versatile; nostrils superior; sternum even on its posterior end.

FAMILY CAPRIMULGIDÆ—"GOAT SUCKERS."

Bill short, triangular, depressed; gape wide, opening beneath the posterior angle of the eye; toes connected by a web; plumage lax, soft and owl-like; wings long.

FAMILY TROCHILIDÆ—HUMMING BIRDS.

Bill subulate, longer than head, straight, arched or curved; tongue composed of two lengthened cylindrical united tubes, capable of protrusion to a considerable distance, and bifid at the tip, nostrils lateral; basal linear covered by a lid; wings long, pointed; primaries ten; secondaries six; tail feathers ten; legs and feet very small; os hyades of tongue lengthened and attached to the hind head, as in the woodpeckers.

Here then we have a long, slender bill, awl-shaped, longer than the head, a protactile tongue composed of two tubes. How markedly different from the short, triangular, depressed and wide bill of the swallows and swifts.

And now, finally, in a few closing words, I would say that all I argue for is to bring the swallows up into close juxtaposition to the swifts, goat-suckers and humming-birds: not assimilate them, but place them next to their kindred—not separated by other and certainly far different birds in habits and many and important points of structure. —H. M.

CORRECTION OF ASSUMED ALTITUDES IN THE UNIT STATES.

Mr. James T. Gardner, the Geographer of the United States Geologi and Geographical Survey of the Territories under Prof. F. V. Hayden, has p lished an elaborate discussion of the evidence upon which rested the suppc altitudes of leading points in the Northern and Western United States, great lakes, rivers, cities, mountains, etc. He had before him a collection over 1,200 railroad and canal profiles, and among this mass were many conf ing statements. Corrected profiles were joined together into various li extending from ocean tide gauges to the interior of the country. These l focusing at great railway centers, gave the means of determining the altitud each of them by a number of independent methods. Different results acc so closely, and evidence is given with such completeness, that Mr. Gardn work must be considered to have established the altitudes of the United Sta The hight of the mean surface of Lake Erie is shown to be 573.08 feet, an Lake Michigan, 589.15 feet above the sea. This differs considerably f former results, and Mr. Gardner points out the old sources of error. The wl lake region is changed by the same amount as the lakes.

The following are some of his results:

	Feet.
The Cincinnati City directrix	439.74
Pittsburgh Main Depot track	746.00
Harrisburg, Penn., Railroad Depot track	319.91
Philadelphia City datum	8.73
Albany, mean tide in river	4.84
Lake Champlain	100.84
Lake Ontario, mean surface	250.00
Indianapolis main depot track	721.75
Cairo, city base of levels	291.23
St. Louis, city directrix	428.29
Chicago, city directrix	587.15
Rock Island, C. R. I. and P. depot track	568.68
Burlington, Iowa, Main-st. depot	531.61
Omaha, top of abutments of railroad bridge	1,049.40
Kansas City, mark of high water of 1844	770.77
Denver, K. P. R. R. depot track	5,196 58
Cheyenne, U. P. depot track	6,075.28
Pike's Peak	14,146.68
Mount Lincoln	14,296.66

These hights are largely different from previous estimates. Our great r way centers and entire States are raised 10 to 115 feet in altitude. The wl of some parts of the continent seems to be much higher above the sea than supposed. One of the most interesting results of the investigation is tha

shows our American railroad levels to be very accurate when long lines are considered. The New York Central and Lake Shore and Michigan Southern railroads joined with the Illinois Central and Southern Railroads to New Orleans make a continuous line of levels 1,800 miles long from New York Bay. They reach the Gulf of Mexico with an error of only two and a half feet. The two great independent lines—the Union Pacific and the Kansas Pacific Railroads—reach Denver with a difference of only five feet. Such accuracy in American leveling speaks well for our engineers. The careful determination of altitudes of high and low water at a number of points on the Ohio, Mississippi, and Missouri rivers is one of the most important contributions, establishing, as it does, the true fall of these rivers at different stages of water, a subject of which our previous knowledge was very inaccurate.—*Tribune.*

CHANGES OF COLORATION IN FLOWERS BY ARTIFICIAL MEANS.

The French *Journal of Horticulture*, in an article upon the changes of coloration which certain natural flowers undergo, remarks that if violet flowers are exposed to the smoke from a burning cigar they change color and assume a tint of green, which is decided in proportion to the brilliancy of their original color. This is due to the ammonia in the smoke. Starting out with this fact, Prof. Gobba has made a series of experiments for the purpose of determining the changes which ammonia produces in the colors of different flowers. For this purpose he merely makes use of a dish in which is poured a small quantity of common aqua ammonia. Over this he places a funnel, in the tube of which are inserted the flowers to be experimented upon. In this way he has shown that blue, violet, and purple flowers change to a beautiful green; deep red carmine flowers to black, white to yellow, etc. These changes are most striking where the flowers have several different tints, in which the red lines are turned green, the white yellow, etc. An interesting example is that of the fuchsias, with white and red flowers, which, in consequence of the ammonia vapor, becomes yellow, blue, and green. If, when these changes have taken place, the flowers are immersed in pure water, they preserve their new colors for several hours, after which they gradually resume their original tints. Another observation due to Mr. Gobba is that the flowers of the asters, which are naturally inodorous, acquire a very agreeable perfume under the influence of ammonia. The flowers of the violet asters also become red when they are moistened with a diluted solution of nitric acid. Again, these same flowers, if exposed in an open box to the vapor of hydrochloric acid, become after some hours of a beautiful carmine red, which they preserve after being dried in the dark, if kept in a dry, dark place.—*Tribune.*

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OPINIONS OF THE PRESS.

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We have before us a copy of the SCIENTIFIC MONTHLY, edited and published by E. H Fitch, of Toledo, Ohio. It is a magazine devoted to Natural Science, and the discussion of Scientific subjects. The number before us has sixty neatly printed pages on tinted paper, and its rare subject matter profusely illustrated with accurately engraved plates and wood cuts. The articles are from the pens of well-known home and foreign writers on scientific subjects. It promises to be a record of new discoveries in the Natural Sciences, which, together with its handsome typographical appearance, renders it equally inviting and entertaining. We pronounce it among the choice publications of its class of magazine literature, and hope it may "live long and prosper."—*Coshocton Democrat.*

PRICE, THREE DOLLARS A YEAR.

Address— SCIENTIFIC MONTHLY,
TOLEDO, OHIO

VOL. 1. No. 9.

JUNE, 1876.

THE SCIENTIFIC MONTHLY

A MAGAZINE DEVOTED TO

The Natural Sciences.

E. H. FITCH, Editor and Proprietor.

TOLEDO, OHIO:
TOLEDO COMMERCIAL COMPANY, PRINTERS.

The Scientific Monthly.

VOL. I. NO. 9.

Price, $3.00 a Year; or, 30 Cents a Number.

All communications, of whatever nature, in regard to the Magazine, should be addressed to E. H. FITCH, Editor and Proprietor, TOLEDO, O.

The columns of the SCIENTIFIC MONTHLY will be freely open for all well written articles on scientific subjects, and the candid setting forth of opinions and views on Natural Science.

Any papers sent to the editor will be carefully preserved, and returned to the contributor if desired.

The Secretaries of Scientific Societies are respectfully solicited to forward to the Editor, as soon after the meetings of their respective Associations as convenient, all reports of the proceedings and synopsis of essays and addresses read before them.

This Journal is published for the purpose of exciting an interest in the Natural Sciences, to disseminate knowledge, and as a vehicle or medium for scientists to give to the world the results of their studies and investigations, their views and thoughts upon nature. It is not established for any private purpose whatever, and is *freely* open for the use of all who may see fit to avail themselves of its pages.

The editor is not responsible for the views, statements or opinions set forth in the articles of contributors, nor does their insertion in these pages necessarily imply an endorsement by the editor.

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ROUGH WINGED SWALLOW—NATURAL SIZE.
Drawn from Life, by E. H. FICTH.

The Scientific Monthly.

DEVOTED TO THE NATURAL SCIENCES.

VOL I. JUNE, 1876. NO.

HIGHWAYS AND BYWAYS OF THE OCEAN.

BY J. MANFORD KERR.

MINOR MOVEMENTS—(*Continued.*)—SURFACE CURRENTS.

The waters of the ocean are extremely sensitive. The gentlest breeze sweeps over their expanse, manifests itself in ripples; and when it lulls the ters loll stalwart

"In bluff, broad-shouldered calm,"

with no trace of disturbance manifested upon their bosom. Furious sto furrow the waters and lash the tattered surges with mad fury upon rocks coasts, but the storms subside and the ocean resumes its undisturbed placic the fury of the elements abates, and no durable impress is left behind.

The extreme mobility which braves the fury of the elements, has also w stood the power and baffled the inventive genius of man. On the land he le hills, throws bridges across rapid-running torrents and over yawning chas girdles the earth with bands of iron, and erects adamantine monuments as d able as time; but upon the surface of the broad ocean there is no trace to i cate that man has ever been there. Proud fleets wander at will over its surf but the wave which follows the keel, effaces the slightest trace of servitude leaves the virgin waters the same as they were on the day of creation.

In the superb ocean, as everywhere else in nature, absolute rest is unkn The waters of the ocean are animated by numerous circulatory currents, wh in their flow, bear some resemblance to the circulation of the blood in ani or sap in plants, carrying water from the surface to the bottom, and from bottom to the surface; connecting the most distant seas; diffusing heat polar regions; transporting glacial waters into tropical climes, thereby tendin equalize the temperature and salinity, and thus preserve a uniformity of con

sition and appearance of the waters. By these currents immense qnantities of water thousands of miles wide and hundreds of fathoms deep are moved across the oceanic basin; and every drop of water which has not already been taken up by evaporation, to undergo various mutations and appear as mist, cloud, rain, snow, glacier, river, rivulet, or rill, is constantly experiencing a change of position.

The existence of these surface-currents of the ocean was long since recognized. That now known as the Equatorial Current is by some supposed to be the great winding "salt river" of the blind bard. Columbus, sailing from Palos de Moquet, a part of Torre de Humbria, in the southern part of Huelva, Spain, to the Canary Islands, leaving the usual route of navigation at Gomera, and launching boldly and confidently into unfrequented and unknown seas, held a course due west, and was carried to San Salvadore, by the tropical return-current of the Gulf Stream, acting in concert with the trade winds which blow uniformly from east to west between the Tropic of Cancer and the Tropic of Capricorn, and a few degrees beyond them. Judiciously following the example of the sagacious Portugese, throughout the entirety of his course through these unknown seas, Columbus brought the sounding line and other instruments of observation into constant requisition, "attended to the motion of tides and currents, watched the flight of birds, the appearance of fishes, of sea-weeds, and everything that floated on the water." After his return from his first voyage to America, Columbus declared: "It seems beyond doubt that the waters of the ocean move with the heavens;" or in the apparent course of the celestial bodies. Prior to the time of Columbus, the Portugese, notwithstanding their then brilliant and unparalleled career as maritime adventurers and discoverers, were totally ignorant of the existence of the great oceanic rivers which traverse the surface of the deep in various directions. Their ignorance is a natural outgrowth from the restricted sphere of their voyages of traffic, adventure, and discovery. For their course of navigation was restricted to a narrow strip of water bordering the coast and confined to the distance to which the unaided vision extends.

The accidental discovery of Porto Santo was the result of a voyage in which a crew of Portugese adventurers were borne out of their limited sphere—out of sight of the land, and into an unknown sea where they dwelt in constant fear of destruction every moment, but were unexpectedly landed safely upon the island above designated. The discovery of this island, which lies so far out of the limits of the range to which their ship had formerly been confined, was accidental, and quite foreign to the avowed object of the expedition.

In 1418 a ship for adventure was fitted out by Prince Henry the Illustrious, son of King John I., of Portugal. This prince having made a voyage in his youth with his father to the Barbary States, acquired such a passion for maritime adventure and discovery that in after life he was designated as Henry the Navigator. The ship fitted out for adventure by Henry, was placed under the command of Gonzales Zarco and Triston Vaz, with instructions to double Cape Bojador, and to proceed thence southwards. This dangerous coast—which is habitually shrouded in mists, and rendered doubly perilous by currents flowing toward the

land—was the southern *ultima thule* of Portugese navigation for upwards of tw years, and was finally passed by the fearless Gilles-Anes—a commander of o Prince Henry's ships sent out for maritime adventure and discovery.

Zarco and Vaz, following the mode of navigation prevalent amongst the tugese at the time, hovered close along the coast of Africa, and necessaril countered difficulties absolutely inseparable with the then advancement of nat science. A sudden stress of weather drove them far (far for the time) into an penetrated sea, landing them in safety upon an unknown island, which i they christened Porto Santo, in allusion, Robertson tells us, to their fortu escape. Although this island was a small mountainous one, its soil, of vol origin, parched by the sun's unimpeded rays, and barren of trees, yet "in infancy of navigation," says the chronicler of their wanderings, "the disc of this small island appeared a matter of such moment that they instantly retu to Portugal with the glad tidings, and were received by Henry with the appl and honor due to fortunate adventurers."

Though this discovery emboldened the Portugese navigators, and fille minds of those in ardent pursuit of a favorite object with new incentives and guine hope, yet it did not add materially to their knowledge. Even Colun with all his genius and sagacity, did not take advantage of this peculiar prov of nature. Indeed, the full fruition of its utilization was reserved for mo sagacity.

It is indeed quite true that for centuries prior to Hippalus' discovery o physical fact of the return journey of the summer monsoon—which disc wrought an entire revolution in the maritime system amongst the Europea tions at the time—the Arabian mariners had been acquainted with and uti this phenomenon. By taking advantage of it they had maintained a mon of Ceylon spices and perfumes, which they sold in the ports of Europe as Ar productions. The prodigious incredulity and lamentably-limited comprehe of egotistical skepticism have led to the denial of this fact. It is not reason to say the least, to demand evidence as conclusive as mathematical demonstra of the advancements and civilization which have passed from existence, w records are scanty, and where monuments are now mouldering amid the rui the past, before giving them credit for any advancement or any civilization.

There is a certain class of persons with whom it is difficult, if not absol impossible, to believe that any advancements or discoveries of any consequ were made prior to the present time. In the simplicity of their ignorance an credulity they remind one of that good old lady who resided in one of the pleasant and secluded savannas of the Green Mountains. This old lady was ited one day by a romantic party of pleasure seekers, who, when she inq where they resided, replied "at Boston"; on hearing their answer the good dame threw up her hands exclaiming: "Oh, how can any body be willing to so far off!"

What the astronomer Hippalus did for the short distance from Egypt to robane (Ceylon Island), Lieutenant Mathew F. Maury, of the United S

Navy, the greatest Hydrographer and oceanic Meteorologist America or the world has afforded,—whose indefatigable researches have unveiled the great laws which rule the winds and currents of the ocean, and, as Baron Von Humboldt declared, discovered a new science,—has done for the whole globe.

Maury was a native of Spotsylvania County, Virginia. He early discovered a predelection for maritime pursuits; and in 1825, at the age of nineteen, entered the United States Navy as a midshipman, actuated by true patriotic devotion and a philanthropical spirit cosmopolitan in its yearnings, with noble self-abegation, spurning all individual aggrandizement, and desiring, like Henry the Illustrious, to be remembered by mankind for *his talent of doing good*, Maury resolved to honor God and subserve the best interests of his fellow man, by giving to the world the fruits of his industry, his imagination, and his leisure. In carrying this resolution into effect he searched earnestly, persistently, and disinterestedly for the ascertainment of *truth*, and when he had once obtained the object of his solicitous search, he boldly promulgated and fearlessly maintained it, regardless of what the world might think or men might say. He was prejudiced in favor of no system, influenced by no pre-speculations, and prepossessed by no theory. In his "Introduction to Explanations to Accompany the Winds and Currents Charts," he announces to the maritime world the rule by which he was guided in all his observations and investigations. He says: My rule "has been to keep the mind unbiased by theories and speculations; never to have any wish that an investigation would result in favor of this view in preference to that; and never to attempt by premature speculation to anticipate the results of investigation, but always to trust to the observations themselves."

A voyage differs *ab initio* from a journey. On the land there are well-beaten highways leading from one point of importance to another; but upon the ocean no such royal highways direct the course of the mariner. The application of steam to navigation demonstrated the importance of rapid inter-communication, and the search for more expeditious routes led to the abandonment of those which had for years been followed by navigators. Not taking into account prevailing winds and the direction of oceanic currents, a steam ship can trace the shortest line between the point of departure and the port of arrival; but with a sail ship the ærial and oceanic currents are the only means of progression, and it not unfrequently occurs, that, because of the absence or adverse influence of these agents, the route the shortest in amount of space traversed is the longest in amount of time required for its accomplishment. The route which furnishes the greatest amount of favorable winds and currents with the least deviation from a straight line is the one over which a voyage can be accomplished the quickest, and is consequently the most desirable. Maury undertook to determine these routes to the various ports over the known world. It was truly a Herculean task, but he was equal to the emergency. It is difficult to properly appreciate the amount of labor he performed or sufficiently, eulogize the indefatigable zeal with which he pursued his object. In speaking of his work as head of the Hydrographical Board at Washington, the *Temple Bar* says: "Here he commenced the great

undertaking with which the name of Maury will be forever identified. H tained copies of as many ships' logs as could be procured, and marked the tion of winds and currents on charts prepared for that purpose. Informati this nature began to pour in until 1842, when he laid before the Hydrogra Board a plan for supplying model log-books to the mercantile, marine, and service. These log-books were designed with a view of registering observ in a systematic series. His idea was adopted, and in the space of eight ye thus collected a sufficient number of logs to make 200 manuscript volun 2500 days each, or nearly seven years of the daily observations of each captain. The digest of these observations gave employment to a large st assistants, and resulted in the 'Winds and Currents Charts', together wit quarto volumes of 'Sailing Directions,' which bear the name of the defati compiler."

Some idea may be conjectured of the immense amount of labor bestow Maury upon the favorite object which he so ardently pursued, when it is k that the construction of the "Winds and Currents Chart," or Plate I., "Physical Geography of the Sea, and its Meteorology," was the result of 1 353 separate observations on the force and direction of the winds, and upwa 100,000 observations on the height of the barometer at sea.

The final result of these labors — observations, compilations, and con sons—was a reduction from one-third to more than one-half of the time req to sail to and from the principal ports of the world. As an illustration of reductions we give three of the principal routes in the following

TABLE.

From where.	To where.	Time. Maury's.	Form
United States.	All points south of Equator.	18 da.	41
New York City.	San Francisco.	92 da.	180
London, England.	Sydney, Australia.	65 da.	125

This shortening of routes did more for the promotion of nautical scienc the furtherance of maritime interests than anything that has been accompl since Chinese genius and sagacity furnished to the world Ting-na-Tchen, th the needle which always points to the south, now known as the mariner's pass. This wonderful instrument was invented (or accidentally discovered) d the reign of the euphoneous potentates who preceded Hoang-Ti, and intro into Europe by Marco Polo, the great Venetian traveller, and the first Eur who entered the Celestial Empire. He remained several years at the co Koablai Khan, the great Mongul who ruled over China and Tartary, and o return to Italy, in 1295, B. C., brought with him Ting-na-Tchen, which w proved by Flavio Gioja (to whom the invention is erroniously ascribed by and William Barlowe.

With a remarkable passion for the novel, and an inveterate and chronic sition to almost everything orthodox, John D. Baldwin—a great admir

Cushite civilization, the grandeur of which he exaggerates, and to which he endeavors to trace everything of consequence, which has come down to us through the dim vista of fabulous antiquity—would fain have us believe that the Chinese received the Ting-na-Tchen from the Arabian Cushites anterior to the reign of Hoang-Ti (2,700 prior to the Christian Era). The evidence upon which he asks us to accept this conclusion is the fact that when Vasco de Gama, who sailed under the patronage of Emanuel, in search of a new passage to India, doubled the Cape of Good Hope, "found the mariner's compass, the asprolabe and other important nautical instruments in general use among the Southern Arabians, who controlled the maritime enterprise on the Indian Seas," and that when he landed at Malabar, about a month after he left Melinda (left M. Apr. 13, 1498, and cast anchor at Calecut, May 22, same year,) he not only beheld wealth, populousness, industry, cultivation, and arts far in advance of what he had supposed from the imperfect and perverted accounts he had received of them in Europe, but also (what seems of great importance to Baldwin's theory) that their mariners used a magnetic needle which was "about six inches long, suspended on a pin, in a white China disk filled with water, in the bottom of which were two cross-lines marking the cardinal points," and which, he informs us, is identical with the "method of using the needle" of "the Arabian race on the Mediterranean." "This," he continues, "indicates that they all had the compass from the same source," which source he assumes to be Cushitic, but may as easily be Chinese as Cushitic.

Let us now turn our consideration to the theme proper—to surface-currents.

Ocean currents are of two general classes, viz: (I.) those that have the plane of their movement in the body of the ocean, that is, deep sea currents; and (II.) those that are confined to the upper strata of the waters of the ocean, that is, superficial or surface-currents.

Having spoken briefly of deep-sea currents in a former article (*vide* "Ocean Currents" in March No. p. 219), it remains for us to call attention to the surface-currents.

Surface currents are the natural and inevitable result of inequality in the level of the waters of the ocean. This inequality of level is produced directly or indirectly by heat and the revolution of the earth; directly through evaporation, and indirectly through winds and continuous heavy rains.

Heavy rains in a particular district, by the addition of fresh water, raise the level of the ocean in that district. To re-establish the equilibrium and uniformity of level, currents, greater or less proportionate to the quantity of fresh water precipitated, will set in all directions from this district.

As already shown (*vide* "Oceanic Movements," April No. p. 351,) heat acting upon the atmosphere disturbs the equilibrium, the re-establishment of which produces an ærial current of greater or less magnitude, according to the amount of disturbance. This ærial current, if continued for a considerable length of time with unabated force, will produce an oceanic surface-current when it passes over the surface of the ocean.

Being constantly heated in the tropical regions by the rays of the sun ocean looses a great quantity of water which is taken up by evoporation transformed into vapor and clouds. Assuming the correctness of the state of Maury that the annual evaporation of the ocean is 14 feet, the quanti water raised in the torrid zone from the Atlantic alone would be nearly 120,(000,000,000 of cubic yards, which is equivalent to a cubic mass of water 30 mil extent. A great portion of the water thus raised is returned to the ocea rain; but we will be safe in declaring that one-half is borne away in clou the trade-winds, and other ærial currents. Hence the tropical ocean l about 60,000,000,000 of cubic yards of water annually. To supply this defi cy there is an in-rush of the cold water from the polar regions, where the q tity of rain, snow, and hail which falls greatly exceeds the loss by evapora This flow of superabudant water from either pole meets in the equatorial where it flows westward in a vast stream 30° in breath. This westward-flo owing to the conjoint operation of two causes, viz: (1) the rotation of the on its axis, and (2) the influence of the trade-winds, which, attracted by force of equatorial heat, blow without intermission in the same direction, ing the waves before them, and thus accelerating the speed of the oceanic rent. The waters of the polar currents, coming from a region where the m of the earth's surface is slower than it is in tropics, are unable to keep pace, may be said to *lag behind*, thus giving westing to the current.

If the quantity of water transported from Arctic and Anartic regions int tropics, was exactly equal to the quantity taken up by evaporation, the equilib would be restored, and there would be no return movement towards the p as there is at present. The equatorial current is not freely developed aroun earth. The interposing of the continents divides the waters of the ocean interrupts the progress of the equatorial current; it strikes the coast of Asia is divided into two currents which flow toward either pole. In the Atlantic principal part flows into the Gulf of Mexico and issues forth as the Gulf Str the most remarkable and best known current of the whole ocean. It has graphically described by Maury as "a river in the ocean; in the severest drou it never fails, in the mightiest floods it never overflows. Its bottom and its b are of cold water, while its current is warm. There is in the world no other majestic flow of waters. Its current is more rapid than the Mississippi or Amazon, and its volume a thousand times greater."

The Equatorial Current is fed by the polar currents. A current from Antarctic glacial sea dashes against the Lugullas Bank, where it divides, branch entering the Indian Ocean, and the other flowing along the we coast of Africa, enters the Gulf of Guinea. The waters from the South are south of the Cape Verd Islands, by those that have been chilled by a sojour the icy seas of the North, and the two uniting flow in a current in the dire of South America and the Antilles. The greater portion of this current through the Caribean Sea into the Gulf of Mexico; but a small portion flo south of Cape St. Roque, follows the direction of the Brazilian coast line.

it progresses towards the southern glacial seas it gradully gains on the rotary motion of the earth, and "lends more to the south than to the south-east, forming a sort of gulf stream in an opposite direction, it strikes the polar current to the east of the Falkland Islands, whose position in the southern hemisphere corresponds to that of Newfoundland in the northern hemisphere." The warm current being of greater density than the polar it sinks beneath the polar when they come in contact. The lighter waters of the cold current continue their course to the north-east, and join the great Equatorial Current at St. Halena. It has been estimated that the whole circuit is accomplished in 1095 day.

In the Indian Ocean the current from the polar regions flows along the coast line of Australia, and uniting with the waters of the Pacific Ocean which come through the East Indian Archipelago and Torres Straits, flows into the bays of Bergal and Oman. The marine currents of the Indian Ocean follow the course of the monsoons. That the general movement from east to west is preserved, is evidenced by the fact that the seas which wash the coasts of Hindoostan and Arabia furnish a current of warm water, which, bathing the eastern coast of Africa, and the shores of Madagascar, passes through the Mozambique Channel into the Antarctic Ocean. Taking its name from the channel through which it passes, this marine river is known as the Mozambique Current, and moves with a speed of near 4½ miles per hour.

In the Pacific Ocean, because of the broad and unobstructed sweep, the surface-currents are much more magnificent than in the Atlantic or Indian. A glacial river of undetermined magnificence sets in from the Antarctic, and striking Magellan Island divides into two branches. One of these doubles Cape Horn and carries its waters far into the Atlantic east of the Falkland Islands, where it joins in the great circulatory movement between Africa and Brazil. The other and principle current, which is known as Humboldt's Current—so called, because this great German savant and traveler was the first to call attention to its abnormal condition, and point out its origin—runs along the coasts of Patagonia, Chili, and Peru, until it arrives near the height of Punta Parina, where it suddenly quits the coasts and mingles its waters with those of the most magnificent oceanic current of the continent, which has a mean breadth of 3,500 miles, and an unascertained depth—the Equatorial Current of the Atlantic Ocean.

The waters of Humboldt Current are from 18° to 22° Fahr. colder than those of the adjoining in the region of Lima, and have a depth of about 670 fathoms, and move with an average speed of about 20 miles per hour. The temperature of the waters of this current reduces the temperature of all the coasts it bathes, and gives to the flora and fauna of Chili a striking similarity to that desolate island of St. Halena, which, 4000 miles away in the Atlantic, as we have already stated, is bathed by an Antarctic current. "Not a branch of coral can take root on the rocks and shores washed by this current of cold water [Humboldt Current:] the Polar Current changes everything on its passage—the flora, fauna, climate, and even the history of mankind. This current is an important auxiliary in navigation; it furnishes a royal highway from Europe to all points on the coast of Chili

and Peru, and also renders other very important services in the economy of ture. It is said that if the air was not constantly refreshed by cold water c ing from the pole, Peru, which is so rarely watered by rain, would be t formed into another Desert of Sahara, and human life would become almost possible there.

The Equatorial Current in the Pacific Ocean follows its majestic and slig impeded course in a straight line more than one-third of the distance round earth (between 130° and 140°), with a depth of at least one mile, and a spee from 30 to 35 miles per day. As it approaches the Asiatic continent, it is dive from its course by the land and divided into three branches. One of these, dr first in one direction and then in another by the monsoons which prevail in region it traverses, flows through the narrow and shallow strait of the East In into the Indian Ocean. Another (and one which comprises by far the gre portion of the south-deflected waters), strikes the coasts of Australia, is defle south, and flowing in the direction of the Antarctic Islands, meets the polar rent off the south of New Zealand, and plunges beneath its waters, which ar lower temperature and salinity. The remainder of the Equatorial Current flected north by New Guinea and the Philipine Islands, which corresponds to Gulf Stream in the Atlantic, is called by the Japanese—who have long kn and prized it for coast navigation—Kuro-Sivo (Black River), and by other nav tors, the Japan Current, or (less frequently) Tessan's Current, in honor of navigator who acquainted Europe with its existence.

The Japan Current flows along the coasts of the Japanese Islands, and a s distance north of Japan meets the cold current which flows from Okhotsk Se supply the quantity of water taken up by evaporation, its waters being of gre salinity and consequently of greater density, although of a higher temperat sink beneath the cold current, continuing a northerly course. A portion of north-deflected current enters, as a submarine current, the Sea of Kamtcha bearing to the Allutian Islands and Alaska camphor-wood and other odorife trees from tropical climates, wrecks of ships, and fragments from Moluccas, P pines, and Japan, passes through Behring Strait, into the glacial Arctic Sea, from thence passing down through Baffin's Bay, freighted with iceburgs, meet Gulf Stream off Newfoundland.

The remainder of this deflection traverses the Pacific from east to west an average speed of 1¼ miles per hour, and an average temperature of from to 12° above that of the waters through which it flows, bathes the shores of and Vancouver's Island, courses the coasts of California, and finally, in tro regions, re-mingles with the waters of the Equatorial Current, having transpo (its waters heated by a long sojourn in tropical climes) spring and fertility to gions that would be subject to a very severe winter without its influence.

Of all the oceanic surface-currents, the Gulf Stream is the most serviceab international commerce, and exerts the greatest influence over the climate o calites; consequently it is more thoroughly studied and better known than other.

Juan Ponce de Leon—a hero of Granada, but a tyrant of the Columbian Archipelago—shorn of regal authority, and chagrined at the deprivation of the gubernatorial powers in an Island which he had conquested, where through the revenue exacted by an oppressive and tyrannic policy of government, he had amassed an immense fortune, in 1512, set out with a fleet of three ships, fitted out at his individual expense, on a voyage of adventure and discovery, in search of the fabled fountain of rejuviniscence, of which he had heard so much from his wild subjects in Porto Rico, and which was supposed to be located on Bimini Island, one of the Lucayos. A tripartite object induced this voyage: (1) To gratify his thirst for enterprise and love of glory, the ardor of which had not been either abated or cooled by disappointment, nor tempered by the approach of silver age; (2) that he might refurbrish a character somewhat tarnished by the blood predatory forays and acts of manifest injustice, if not gross cruelty and inhuman barbarity, by the discovery and conquest of a new country to replenish a purse becoming lank under excessive prodigality, as well as reinstate himself in royal favor; and (3) to restore the cheek now carrugated and sallowed by years and hard service and the sultry sun of tropical lands, to the smoothness and flush of youth.

Ponce de Leon remained an old, wrinkled, sallow and spirit-broken man, but Spain rescued a new province from the domination of wild nature, and commerce acquired a new and valuable thoroughfare; for in this voyage—although he failed to find the fabled fountain in whose magic waters resides a power potent to renovate the life of those who bathe in them, or give perpetuity of youthfulness and happiness to the fortunate mortal who should drink of the ever-flowing fountain—Ponce de Leon discovered Florida and the Gulf Stream.

In 1518 Antonio de Alaminos, a reckless Spanish adventurer who accompanied Ponce de Leon on his voyage to Florida in his search for the Fountain of Youth in 1512–13, allowed himself to be carried by the current of the Gulf Stream from the region of the Tortugas into mid-ocean. He was the first navigator who ever followed, for any considerable distance, the circuitous route which has been pursued for centuries by ships in order to secure a speedy return to European countries form the New World.

Bernhard Varen, a renowned Dutch geographer and physician, the founder of scientific geography, attempted to describe the Gulf Stream in his "*Geographia Generalis*," published in 1650; and shortly afterwards Isaac Vassiur, an eminent Dutch scholar, traced its immense circuit on a map. Benjamin Franklin, the renowned American philosopher who deprived the clouds of their fire and rendered the bolts of Jupiter harmless, and Sir Charles Blogden, an eminent English physian and chemist, an intimate friend of Sir Joseph Banks, the naturalist, were the first to explore it scientifically. Since then it has been studied by numerous geographers and naturalists. But of all who have studied this wondrous phenomena of oceanic circulation, Capt. Maury, of whom mention has already been made, stands forth the most conspicuous. His "Geography of the Sea, and its Meteorology," which the *Temple Bar* pronounces one of the most charming

books in the English language, will be transmitted to posterity, a blessing to
igation, and an imperishing monument of the enduring fame of its author.
varied scientific information, and indefatigable labors of this man are well wo
of the admiration and gratitude they have received.

The tropical waters of the Atlantic are impelled towards the west wit
incessant movement which carries them to the coasts of tropical America. W
this vast current, 30° in width, breaks against the shores of the New World,
of it are deflected to the north, and 10° to the south. The northern deflec
following the outline of the coasts, makes its way through the Carribean Se
the Gulf of Mexico. The time required for its journey from the Lesser Ant
to the *debauchure* through the Bahama Straits into the Atlantic, is six mo
During all this sluggish journey the waters are subject to the burning heat
zenithal sun, the intensity of whose rays is greatly augmented by the contou
the land of the adjacent coasts. The Gulf, particularly, is situated in the to
zone, and bordered on all sides by lofty mountains which shut up the solar
as within a vast funnel, and transmit to the waters the scorching heat of
burning climate.

After having revolved in this tropical caldron for six months, driving
muddy waters of the Mississippi to the Alabama coast, the Gulf Stream fl
along the northern shore of Cuba, and issue through the Florida Channel
the Atlantic Ocean, over the waters of which it glides like a serpent over the l
After leaving the confines of the Columbian Archipelago, the Gulf Stream
comes a mighty marine river of great salinity, high temperature, and a deep i
go-blue, confined within a channel, the sides and bottom of which consis
waters of a less degree of salinity, a lower temperature, and of a greenish c
Following the outlines of the continent, this marine river flows in a north
course to the banks of Newfoundland, with an average speed of from 3½
miles per hour, a width of 37 miles, a depth of 220 fathoms, and a volume of
000,000 cubic yards per second.

On emerging from the Strait of Behimi, the watery walls gradually reced
the Gulf Stream gradually increases in breadth and diminishes proportionatel
depth, so that when it has traversed the Atlantic it is transformed from a nar
deep, and rapid-running stream, to a sluggish superficial sheet extending fron
volcanic and fertile Azores on the south, to the inhospitable latitude of Iceland
the glacier-coated shores of Spitzbergen on the north.

At the Banks of Newfoundland,—the common morain of northern icel
—the Gulf Stream encounters a polar current of glacial waters. The latitu
contact is not fixed, but varies from 43° to 47° north latitude. The var
phenomena of the ocean and the atmosphere being the result of solar influe
the ærial and marine currents travel south as the sun recedes from nort
climes. From September to March the waters of the glacial sea are predomin
and the waters of the Gulf Stream recede to the 43d parallel; while from M
to September the waters of the tropical current regain their northern suprem
and penetrate as far as the 47 parallel.

The greater portion of the gelid waters of the Polar Current passing beneath the tepid waters of the Gulf Stream, preserve a counter-course, carrying with them immense fragments of ice, only one-eighth part of which is visible, and which plough through the waters of the Gulf Stream, in direct opposition to the course of their flow, like a screw-propeller through the clear waters of a placid lake.

That portion of the waters from the glacial sea which does not pass beneath the tropical current, spread over the surface laying between this current and the American coast, bounding the Gulf Stream on the west as with a wall of ice. The most rapid flow of the Gulf Current is along this ice-like wall. The line of demarkation between these counter-carrents is frequently so distinctly defined as to be discernable to the naked eye, and it is said that the exact momont when a ship leaves one current, to cleave the other with its prow, may be distinguished.

The Gulf Stream, in its progress across the Atlantic, becomes triparted; one branch continues a northerly course and enters Baffin's Bay, flows along its eastern boundery, giving to the western coast of Greenland a terperature warmer by 9° Fahrenheit than that of the eastern coast at the 78 parallel; here it becomes a submarine current and continues its northerly progress through Davis Strait to reappear as a surface-current in the open polar sea of Kane (?)

A second-branch bathes the northern coasts of Ireland and England, melts the ice of the harbor of Hammerfest, transporting productions of Norwegian art, and the severed fragments of the nets of Scandinavian fishermen, to the northern coast of Nova Zembla, and carrying vegetable products from the Antilles to Shoal Point. It encounters at Nova Zembla the current of cold water which Baron Wrangell, a Russian admiral and navigator, famous for his "Journeys on the Northern Coasts of Siberia and the Icy Seas," informs us washes in a westerly direction the northern coast of Siberia, and "encountering on its way the large island of Nova Zembla, it covers the strand and rocks with enormous quantities of ice, which render the island quite uninhabitable, and close the straits of navigation." Here the tropical current becomes a submarine sheet, is deflected to the north and flows north-westerly towards Spitzbergen, bends round the northern archipelago, and enters the seas off Greenland; through these it flows with an average speed, according to Graah and Scaresby, of from three to four miles per day, giving to them the strong salinity announced by Forchhammer, the Scandinavian chemist. From the glacial seas around Greenland it retnrns with the polar current to the tropical seas.

A third branch is deflected to the south, opposite to Spain, joins the tropical current off Central Africa, and makes its way towards the American coast, re-entering the tropical caldron, and re-issuing from the straits of the Columbian Archigelago, continues the eternal circuit. This circumvolutionary voyage of from 13,000 to 19,000 miles, requires for its completion about 1280 days.

This last branch sends off a secondary branch which strikes the shore of Galicia and flows along the Iberian coast into the Bay of Biscay. From thence it flows northwesterly, forming a liquid barrier across the English Channel, a por-

tion of it penetrating into the Irish Sea, and the remainder, continuing its north course, joins the second tripart off the northern extremity off Ireland, and ret ing with it in its polar-submarine course to the tropical seas. South of C Clear this marine river is known as Rennell's Current, after James Rennell, English geographer, who first discovered its existence, and published it to world iu his "Investigation of the Currents of the Atlantic Ocean."

The long sojourn of the waters of the Gulf Stream in the Carribean Sea the Gulf of Mexico, greatly increases the freight of heat and salinity with w the Equatorial Current comes ladened. The normal salinity of the waters of Carribean Sea is about 37-1000. In the Gulf of Mexico the accession of f waters has reduced it to less than 36-1000 of saline substance; but this is gradu increased in the current's northerly progress. Off the Grand Bank of Newfou land the influx of fresh water occasioned by the discharge of rivers, heavy r falls, fog, and the melting of snow and icebergs transported from the fields of reduces the salinity to less than 34-1000, but 35-1000 is attained as it turns tow the coasts of Western Europe and the Polar Seas.

The normal temperature of the Carribean Sea and Gulf of Mexico is n higher than that of the Equatorial current at its commencement, or during stage of its voyage prior to its arrival at the Lesser Antilles, or, in fact, of area of the ocean of the same latitude. This high temperature is undoubt partially owing to the influx of water from the Torrid seas, but it is equally dent that it is mainly due to the intensity of the caloric reflected from the rounding mountains, which have been very properly denominated the *T Caliente.*

The Gulf Stream issues from the Florida Channel ladened with the gre portion of the caloric stored in the tropical caldron. The heat of this cur has been said to be sufficient, if concentrated upon a single point, to fuse mo ains of iron and cause a stream of melted metal as voluminious and impetuo the Mississippi to flow forth. "It would suffice also to raise from a Winter Summer temperature the entire column of air which rests on France and British Isles. But though it is spread over enormous spaces to the west north of Europe, the Gulf Stream does nevertheless exercise a preponderatin fluence over this part of the Old World. Owing to the warmth of its wat the lakes of the Faroe and Shetland Isles never freeze during Winter; G Britain is enveloped in fogs as in an immense vapor-bath, and the myrtle gr on the shores of Ireland, the 'Emerald Isle of the Seas,' under the same lati as Labrador, that land of snow and ice. In green Erin, an island privilege so many respects, the western coasts (the first land which the Gulf Stream counters after crossing the Atlantic) enjoy a temperature two degrees higher that of the eastern coasts. In spite of the path of the sun, it is, on an aver as warm in Ireland under the 52° of latitude as in the United States under 38°, or about 1025 miles nearer the Equator." The inhabitants of the t waters very frequently make excursive voyages along the course of the Stream without being conscious of the fact that they have departed the realı

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which their nature and constitution have consigned them; and tropical birds aquatic habits very frequently mount far into northern regions, resting upon the bosom of the current, or gently gliding with the superpored ærial current from their tropical home, which preserves a trend uniform with that of the Gulf Stream. While the animals to the north of this stream are securely incarcerated within the glacial ocean. Many of them, as Maury says of the "right whale," "recoil before the Gulf Stream as before 'a barrier of flame.'"

ROUGH WINGED SWALLOW.

(*Hirundo Serripennis.*)

Until within a comparatively short time the rough winged swallow was either unknown or confounded with the bank swallow, which it resembles very closely. Wilson overlooked it in his American Omithology, and many other writers in this and other countries who treat of American birds, either absolutely ignore it altogether, or meerly mention it.

The rough-winged swallow differs from the bank swallow chiefly in being destitute of the bunch or tuft of feathers on the tarsus, in having the fibers of the outer web of the first primary recurved into stiff hooks, and in being somewhat larger. A comparison of our two figures of the natural size will show the difference between the two species better than pages of description.

The rough-winged swallow inhabits the whole of the Uuited States, from the Atlantic to the Pacific; it is also found in Mexico and the Southern parts of British America—it breeds throughout this range. In the Atlantic coast States north of New Jersey, it has not yet been met with, however. This species sometimes burrows into sand banks like the bank swollow, and at other times constructs its nest about the abutments and piers of bridges, or the rafters of buildings When the nest is placed in burrows in sand banks it is at the interior extremity of the hole, which is about three feet long. The nest is composed of dry grasses and leaves with a few feathers intermixed. The eggs are six, pure white, oblong, and .75 inch by .53 inch. This swallow arrives in Ohio about the last of April, and departs for the South about the middle of September.

COLORS.

The rough-winged swallow is of an ashy or smoky-brown color, the chin, throat, breast and sides of the neck, side under the wings, and under wing coverts, are a grayish brown or mouse gray, rest of lower parts white. Many of the feathers above, especially the wing coverts, secondaries and tertials, are bordered with a paler shade at the edges; bill black.

DETAILED MEASUREMENTS.

Extent of wings twelve and two-eighth inches.

Tip of upper mandible to end of longest tail feather five and one-eighth inches.

Tip of upper mandible to end of claw on middle toe four and one-eighth inc
Tip of upper mandibe to forehead two-eighths of an inch.
Tip of upper mandible to hind head one inch.
Tip of upper mandible to corner of mouth four-eighths of an inch.
Tip of upper mandible to outer curve of nostril one-eighth half-eighth inch.
Tip of upper mandible to outer corner of eye one-half inch.
Tip of upper mandible to chin feathers, one-eighth half-eighth inch.
Diameter eye, one-eighth of an inch.
Diameter nostril, one-fourth-eighth of an inch.
Hight of bill at nostril, half-eighth of an inch.
Width of bill at nostril, one-eighth half-eighth inch.
Tarsus, three-eighths of an inch.
Middle toe, three-eighths of an inch; its claw, two-eighths half-eighth inch.
Inside toe, two eighths of an inch; its claw, one-eighth half-eighth inch.
Outside toe, two-eighths half-eighth inch; its claw, one-eighth half-eighth i
Hind toe, two-eighths of an inch; its claw, two-eighths half-eighth inch.
Carpel joint end longest primary, four inches and a half inch.
Carpel joint end secondaries, two inches and a half inch.
Tail middle feather two inches long.
Tail outer feather, two inches, three-eighths inch long.
Tail beyond upper coverts, six-eighths inch.
Tail beyond lower coverts, three-eighths inch.
Tail beyond claw on middle toe, one inch.
Longest primary extends two-eighths inch beyond end of longest tail feathe
Depth of fork to the tail, two-eighths inch.
First wing quill longest, and two inches longer than secondaries.

Four plates on tarsi in front, one on each side, joining frontal plates and o other in a sharp edge behind; 13 on top middle toe, 11 on outside toe, 10 o side toe, and 6 on hind toe.

Outside toe longest, its claw just reaching base claw on middle toe; claw hind toe reaches base claw on middle; hind toe and inside toe just equal in len

The secondaries cover one-half the wing. The bill is contained in the l four times. The tarsus is equal to the middle toe and one-half the skull. C web to the first wing quill only just as wide as the shaft, for the upper and l three-fourths of its length; lower tail coverts long, reaching nearly to end of tail just half the wing, equal to carpel joint to end of secondaries. Bill short, triangular; nostrils basal lateral, open, circular, margined behind. Legs feath to the knee; twelve feathers in the tail. Highth of bill at base one fourth length; its width three times its hight; outlines of the angle of the rami of bill rounded; the feathers extend to beneath outer corner of nostrils.

The skull is very narrow between the orbital openings, and widens ra behind; the occipit is rounded, quite bulging; the temporal fossa is pretty d and wide; the orbital openings are very large, being three and one-half ei inches from front to back, and two and one-half eighth inches from top to bot

The forehead is narrow and depressed in the centre. The ethnioidal plate which forms the inter orbital septum is perfect, and the two orbits separated by the bone. Basal joint of middle toe adherent externally for nearly its whole length; internally scarcely half way.

ON CERTAIN LAND-LOCKED PONDS AS NATURAL METEOROLOGICAL REGISTERS.

Prof. L. S. Burbank read* a very interesting paper upon this subject before the Boston Society of Natural History in December, 1875. It is well known that there are scattered all over our country many small lakes and ponds which are entirely land-locked, having no outlet, and many of them receiving no water from inflowing or tributary streams. Yet it is well known that the hight of water in these lakes varies through a vertical range of several feet, and it is as Prof. Burbank says a common saying among the inhabitants of the vicinity of some of these ponds that "*the water is highest in a dry time,*" "and also that it *rises and falls regularly once in seven years.*" These sayings, as the Professor says, are not altogether without foundation in facts, for the water is often much higher in dry weather in midsummer than during a wet season or during the copious rains of the Autumnal Equinox. Abundant facts go to prove that there are also fluctuations in the level of the waters ranging through several years. Now these facts can not be explained by the popular idea that they are caused by subterranean feeders, or outlets, nor by springs at the bottom of the lakes. The hight of the water is, as our authority says, undoubtedly regulated by the combined effects of the rain fall and evaporation, and no boubt if accounts and extended observations were made upon such bodies of water valuable results might be attained.

Prof. Burbank says: "The inference is obvious that careful measurements and records of the varying hights of the water in such ponds throughout the State continued for a series of years, would aid in the solution of several important questions relating to our climate.

1. The ratio of evaporation to rain fall may be determined.

2. The question whether our climate is gradually growing drier may be solved.

3. The effects of forests upon precipitation and evaporation may be settled by the aid of observations made upon such ponds when surrounded by woodland, and afterwards, when the forests have been cleared away.

Prof. Burbank made some obervations upon a pond in Lancaster, Massachusetts. This pond is entirely land-loeked; no water flows from it at any season, "nor does any stream flow into it." Its area is only thirteen acres, but it is very deep, in some parts sixty or seventy feet. "It occupies one of the deepest valleys in a mass of glacial drift, which covers an area of two or three square miles,

*Proceedings Boston Society Natural History, Vol. XVIII.

BANK SWALLOW—NATURAL SIZE.
Drawn from Life, by E. H. FITCH.

and which is very remarkable for its uneven surface, deep slopes and long narrow ridges." In this pond the hight of the water varies through a ve range of about six feet.

To illustrate the yearly fluctuations of the level of the water, the Prof gives the following facts observed about 1852:

"For several years the water had been quite low, and a dense grow Pitch Pine (*Pinus rigida*) had grown up along the margin, near the water. these pines had attained about seven years' growth, the water rose several and stood above their roots during at least one whole season and until the were all killed by the moisture."

The Professor says: "It is not necessary to seek an explanation of acts in the popular notion that the pond is fed entirely by springs at its bo or has a hidden outlet by which its waters are discharged at intervals." hight of the water is undoubtedly regulated by the combined effects of the fall and evaporation."

BANK SWALLOW.

(*Cotyle Riparia.*)

We have here a very common and interesting little bird. Who ha watched the multitudes of Bank Swallows circling around their nests plac holes burrowed in the face of sand banks? This species seems to be cosm tan in its habits, no difference being appreciable between European and A can specimens. Its range extends over the entire continent of North Am Mexico, Central America and the West Indies to the northern portion of America. It is found in the western portion of Brazil, and in various p the Old World. In Winter it is found in the northern portion of Afric Asia. It has been seen in India, Siberia, and Europe. It is found generally dispersed up to the extreme northern regions. In all this wide it is somewhat local in its distribution, in some particularly favorable loc being quite abundant, and in other situations, often in the immediate vi it is either entirely absent or very rarely to be found.

The Bank Swallow is an early Spring arrival, appearing in Ohio abo first of April. In the Arctic regions it often appears early in May while the is yet to be found in patches and the chilly wintry blasts compel it to seek r and shelter within its burrows. In Alaska and the extreme northern portio British America it is very numerous in Summer.

The Bank Swallow is social in disposition, breeding and associating in large flocks. Its flight is rapid but flickering and tortuous. It drinks or l by dipping into the water as it skims over its surface in its flight. Its foo sists of small insects, captured as it flys, often picked from the surface of the The nest of the Bank Swallow is placed in the further or interior end of the excavated by itself in banks. To effect this the bird rests upon its feet,

its tail also as a support, turning upon its feet as a pivot and digs with its bill, thus forming a circular opening. The burrow is from fourteen inches to five feet long and two inches in diameter, though the average length is two feet. They are circular and inclined slightly upwards as they progress inwards from the mouth, so that no water can reach the nest, which consists of a few dry grasses, straws, leaves and feathers placed at the inner extremity. This innermost extremity is somewhat enlarged into a spherical apartment, perfectly smooth and regular. The eggs are five, pure white, oblong, and 1.72 inches long by .47 wide. The time the little bird takes in excavating its long gallery varies with the nature of the soil. Where it is soft and easily worked the work is completed in four days. When it is hard and difficult to excavate two weeks or sometimes more are required. Both sexes assist in the work of excavating.

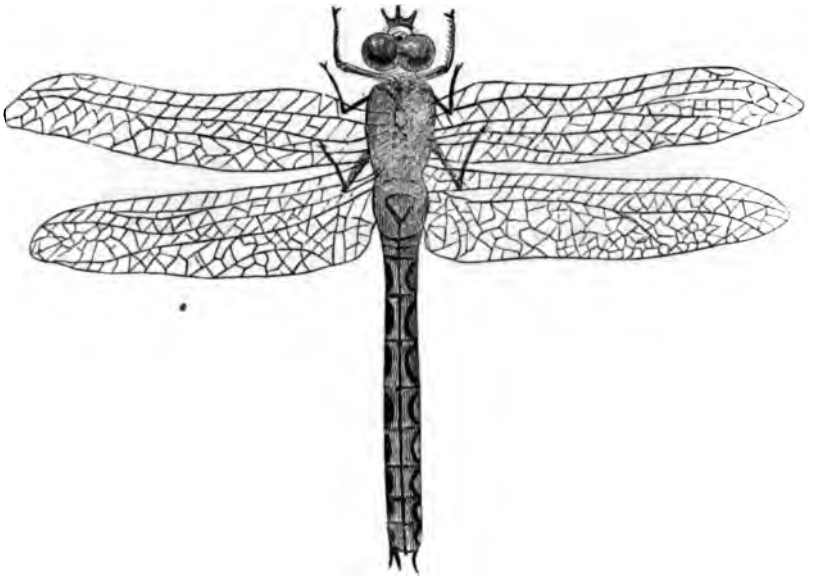
The Bank Swallow has no song; but utters a low sort of chirrup or succession of rapidly repeated notes.

DESCRIPTION.

The Bank Swallow is of a grayish brown color above, the feathers becoming paler at the edges; the lower parts are white with a band of the color of the back across the breast; sides, under the wings, like the back; bill black, small, flat, triangular; nostrils lateral, overhung by a membrane; tarsus equal to middle toe; lateral toes equal their claws, reaching to base claw on middle toe; tarsus with a tuft of feathers attached to its posterior edge at the base of the hind toe; basal joint of middle toe adherent externally to the end, internally only half way; tail forked half as long as the wing from carpal joint; length, tip of bill to end of longest tail feathers 4.75; wing 4 inches long; tail 2 inches long; primaries 9; tail feathers twelve; the outer one on each side the longest.

DRAGON FLIES.

The familiar and beautiful dragon fly, with its transparent gossamer lace-like wings, and brilliantly colored body, is one of the most striking objects in nature. Dragon flies are very voracious, and are the birds of prey—the hawks and eagles of the insect world—for they live entirely upon smaller insects. They are very useful to the human race on account of the great number of injurious insects which they destroy. A few dragon flies shut up in a room will, in a very short time, destroy all the mosquitoes, flies, and other small insects, in the apartment. To man the dragon fly is perfectly harmless, for they can neither bite, sting, poison, nor suck the blood, while in shape and brilliancy of color they are surpassed by few of the insect world. Of strong, vigorous and graceful flight, they also have a peculiar light and airy appearance, and are frequently seen flying over the surface of rivers and ponds, or open fields, in pursuit of their insect prey, alighting for a few minutes, then shooting off again upon their swift and vigorous flight. In some respects the dragon flies resemble the fly-catchers among birds, for they



DRAGON FLY—NATURAL SIZE.

sometimes await perched upon some post or branch of a tree for passing ins upon which they dart with the swiftness of an arrow, which having caught, alight to devour, first pulling off the wings. They dart with falcon-like swift and fierceness upon gnats, butterflies, and almost all soft-bodied insects, and even attack and devour their own species. The life and metamorphasis of dragon fly is full of interesting and wondrous facts. The larvæ and pupæ l inhabit the water from which the perfect insect emerges. The empty pupæ c are often seen hanging to the leaves or stems of aquatic plants. They are eq voracious in the larvæ state. The larvæ are without wings, and have six But what is most remarkable about them is the complicated arrangement of parts forming the under lip, which resembles a mask, covering the face and cealing the mouth, and serves by unfolding its plates to seize and carry foo the mouth. This mask consists of two principal pieces, one of which is ar lated to the head; the second is attached to the outer extremity of the first p At the apex of the second piece two jaw-like organs are articulated. In re this mask is folded up beneath the head, but can be immediately and sudd extended to a considerable distance from the head so as to seize minute insec fish that may pass near the larvæ, which is sluggish in its motions. Thus atti this fierce and cruel masked warrior crawls stealthily along the bottom of pond like a cat, and when it arrives within reach of its victim, springs its joi mask upon the unsuspecting insect or even small fish; and so sure is its aim so stealthy and insidious its approach that few escape its clutches.

By a singular and beautiful valvular arrangement at the end of the tail larvæ draws in and expels water, using the jet against the surrounding wate means of locomotion. Respiratory trachea are placed along the side of the b These larvæ exist for several months in the water and change their skin sev times.

The nymphs have only rudimentary wings; and when ready to undergo final change into the perfect dragon fly, the large and brilliant eyes of the fu insect can be plainly seen under the transparent enveloping skin. They crawl out of the water upon the bank or fix themselves upon some aquatic pl and here, safe from their former watery home which they now are about to sake for a life in the free air above, the final change is undergone: the pupæ becomes dry and crisp, it bursts open on the back, the head and shoulders of insect are thrust forth, then the legs are drawn slowly out, and now appear wings, which are gradually drawn out and expanded. While the wings are ing the body is bent into a crescentic form, so that the delicate texture of wings may not be injured by contact with any foreign substance. Accordin some writers the dragon fly is two years in reaching its perfect state from the then after spending a few weeks flying about in the air, having performed the of reproduction, they gradually loose their strength and die.

The dragon fly has four large transparent wings of nearly equal size; eyes are latral, large and protuberant, with three stemmata upon the top of head; the mouth is strong, provided with horny mandibles and spiny max

The abdomen is long and slender, cylindrical, soft and without a sting, terminating, in the male, in two lamellar appendages. The antennæ are composed of from three to six joints; legs six, short and directed forward, arising from the thorax, which is firm, composed of three united segiments. The female deposits her eggs upon aquatic plants, beneath the surface of the water.

Dragon flies are divided into many genera. The members of the genus libellula hold the wings horizontanally expanded when at rest; the body is flattened, head large and globular; in this there are over twenty species in the New England States alone.

In the genus æshna the body is long and slender, the wings are expanded as in the other genus, horizontanally, when at rest, the larvæ long, slender, flat below, rounded above.

In the genus agrion, the wings are held perpendicular when at rest, the body is long, slender and tapering, the eyes set far apart. The larvæ have small, slender, round bodies, terminating in three feathery appendages.

The light, airy and graceful forms and brilliant colors of the dragon flies can but excite our warmest interest and admiration; add to this the strange and wonderful changes they undergo, and it is no wonder that this class of insects have ever been favorite subjects for study and investigation—in the cabinet they form very conspicious objects, well worthy the care of the collector. Among some ignorant persons there is a strange and unfounded belief that the dragon fly is in some way injurious to men, and the sight of one of these beautiful and harmless insects in a room will drive them trembling with fear from its vicinity. The dragon fly is also entirely harmless to the cattle or crops of men, and for reasons before stated should be protected by him.

GREENLAND.

To the present inhabitants of the earth the word Greenland seems highly inappropriate, for a more desolate barren country could not be well imagined.

Greenland is an immense body of land lying north-east of the North American continent, and separated from it and the islands north of America by Davis Strait, Baffins Bay and Smith's Sound; it lies 300 miles west of Iceland, and extends north from Cape Farewell, its most southern extremity, towards the North Pole as far as navigators have penetrated, while towards the south it tapers to a point, widening as it extends northward until in latitude 70° it attains a breadth of 600 miles, which it maintains to the most northern point reached. This vast body of land presenting the dimensions of a continent, whose entire interior consist of a dreary mountainous region, covered with perpetual ice and snow, which never melts, while the coast presents a high rocky barrier, with here and there an opening glade or bay, is on account of the great body of land spread out toward the north, much colder than corresponding latitudes in Europe; through June and July the sun is constantly above the horizon and presents one continuous day, the

sun never setting, while its heat melts the ice that lines the coast, which br up and floats off southwards, the great glaciers that are constantly moving d from the mountains in the interior, push out from the shore and are broken o the waves and fall with a great crash into the sea, forming ice-bergs. No t grow in Greenland, the natives being dependent upon drift wood that floats i their coasts and upon whale and seal oil for fuel. The Fauna and Flora o cold a climate is not rich in species. The sea abounds in whales, sharks, wa and seals. From the shark the natives extract a very pure oil; upon the land found the artic fox, reindeer and polar bear; birds are numerous, auks, g petrels and the eider duck, are especially to be noted. The western coas Greenland has been subsiding for a long time from Igaliko frith to Disco Ba distance of 600 miles, at numerous points are to be seen submerged ruins of a ent buildings that once stood upon high dry land. The inhabitants of Greenl consist of Esquimaux and a few Danes, who have a few isolated settlements s tered olong the coasts. In a climate where for more than half the year the su hid below the horizon, and a perpetual night of more than five months prev and where the thermometer sinks to 68 degrees below zero in winter, where a hol freezes, and where the short summer—for they have no spring, as we accustomed to see it, the long winter breaking suddenly into the short summ is not sufficient to melt the ice from the interior. No great advancement ca expected in life or manner of building, for life here seems to be a perpetual st gle between starvation and freezing. McGahan thus describes this desolate la

"The coast of Greenland presents a broken serrated line of high, rug mountains, that rise abruptly out of the water, in lowering perpendicular mas to a height of 300 feet. Over these the sun and atmosphere combine to pro the most fantastic effects of color. A thin veil of mist gathers over them, as drape and hide their savage nakedness—a kind of spider-web of gigantic pro tions, that catches the sunlight and holds it prisoner in the meshes of a fairy that folds itself caressingly around the stern and rugged heights in a luminous of purple-rosy light, and blends here and there into the yellow trembling glim of a glacier. Here and there are sharp, needle like peaks, behind which ma seen, gleaming white in the sun, the mighty sea of ice, 4000 feet deep, which overwhelmed Greenland."

"The whole of this great continent is, in reality, nothing but one imm deep glacier, with a fringe of mountains around it, forming the coast line. glacier has never been explored, never been crossed, and probably never will for yawning gaps and fissures, many hundred feet in depth, traverse it in e direction, and intercept forever the traveler's way."

The interior of this great continent is an icy solitude that is a secret unkn to man, an immense frozen desolate waste, and it will probably always re so. Its surface is 4000 feet above the sea, and when you ascend to it, you probably perceive somewhere on the plain which rises before you in a sl ascent 'till it touches the sky, two or three little sharp conical hills, a few high, that pierce through the ice; and you will be astonished to learn that t

insignificant mole hills are in reality the tops of lofty mountains, that have been submerged beneath the mighty inundation of ice.

Somebody has said of Switzerland, that if it were ironed out, it would be a vary large country. If Switzerland were about ten thousand times larger than it is, and ice were then poured into it until it should be full up nearly to a level with the highest mountain peaks, it would present just the appearance of the interior of Greenland."

And yet the whole of this vast continent was, at one period of the earth's history, green and fertile.

There have been found here forests of carbonized trees and plants, and the fossil remains of many animals that could only have existed in a warm climate; fossil corals and sponges are often picked up now in Lancaster Sound, and on the shore of Beechey Island. It is very certain that the climate was soft and mild, and that the country was covered with trees and verdure, and it is equally certain that this terrible inundation of ice came and buried every vestige of it, as Herculanœum and Pompeii were buried beneath the ashes of Vesuvius. But instead of the two poor little villages, and perhaps a few square miles of the adjacent country, that Vesuvius covered with its fine ashes as with a soft warm blanket, here is a continent larger than the whole of Europe, buried beneath a massive sea of ice. It is as though the waters of the flood had suddenly frozen to the very bottom, and had never thawed.

What terrible convulsion of the earth's crust, what mighty effort of the forces within her bosom, has wrought such stupenduous changes in this great continent? once blooming with verdure, its surface clothed in green and draped with foliage. Now desolate and drear—a frozen sheet of solid ice.

The Scientific men peering continually into the depths of ages, would fain believe they have discovered the secret, that they have torn aside the dark curtain of the past, and dragged the mystery forth to light. In order to explain the theory as set forth by Prof. Geike in his Great Ice Age, it will be necessary to begin by saying that the "glacial period," of which we continually hear in discussions about geology, was a period when Britain and the whole of Europe and Siberia were in exactly the same condition in which Greenland is now, but long before the time when this continent is supposed to have been enjoying a mild climate. These changes, it would appear, are in great part owing to the following causes:

For the last seventy or eighty thousand years—the difference of a few thousand more or less does not matter—the inclination of the axis of the earth to the ecliptic has been slowly increasing; in other words, the North Pole is gradually leaning outward from the sun, so that if it should keep on long enough, say a few billion years, the earth would take a position in which the axis, if prolonged far enough, would pass through the sun.

The consequences of such a change in the climate and seasons would be incalculable. The Poles and Equator would, to a certain extent, change places. The Equator would, twice during the year, have an arctic day, when the sun would

go around the whole horizon without setting, but it would never have an a night. The Poles would each have successively six months day, and six mo night, as at present, but the day would be the day of the tropics, with a burn fiery sun, directly overhead; the night would be the night of the arctic, results upon the climatic conditions of the globe that are beyond computation. is unnecessary, however, to consider these results further, as they could only l an actual interest for our decendants of some millions of years hence. Besid would appear that the change in the inclination of the earth's axis will never l great as I have supposed. This inclination goes on increasing for about a dred thousand years, then it commences to decrease, and the axis begin resume its former position, approaching the upright; in other words the N Pole, as the earth goes spinning around the sun, sways back and forth like stem of a top that is gaining or losing its perpendicular. It is a kind of giga pendulum, whose oscillations each mark a hundred thousand years. Sligh these oscillations are—they are only a few seconds—their effects, neverthe upon the earth, owing to the fact that different regions are brought successi under the more direct influence of the sun, are enough to appal the imaginat We have not yet reached the extreme limit of our present swing, and already immense continent, larger than the whole of Europe, has been engulfed.

England and Europe must inevitably follow and become as Greenland no and, indeed as they once were, if Agassiz is right. All our great cities, churches, our temples, our monuments, that we rise with so much care, Lon Paris, St. Paul's, Notre Dame, will be ground to sand beneath the mightly mo mass of ice. Even the Pyramids would be swept away, and the huge block which they are built, ground down to the size of marbles, by this terrible mill st The millions of people, our boasted civilization, so hardly acquired, our progr gained at the expense of so many thousand years of painful effort and suffer our art, our science, our literature, all the efforts of mind, even Homer Shakespeare will disappear, and leave not a track behind.

Then after the destruction has been accomplished, when the ruin is comp the pendulum will swing back again, the ice will melt, vegetation will again sp up and there will be room for amother race of men, who will know as little o as we know of our predecessors. In the course of 50,000 years, perhaps, at cost of five hundred centuries of suffering and toil, a fifty thousand years' bat, during which untold millions must suffer and die, they will, perhaps, l reached our present proud position; to be in their turn wiped out, like the on a school-boy's slate, as the pendulum swings back again."—*McGahan Under the Northern Lights.*

SCIENCE VS. REVELATION.

M. A. Booth, Longmeadow, Massachusetts.

An old question, oft repeated, threadbare almost, yet a question still. us look for a moment at some of its aspects. From the soul darkening, mind-fettering religion of Galileo's day we should hardly have expected aught else than the result which followed the announcement of Galileo's discovery. But in our own day, in a country so professedly christian that the name of God is stamped upon its coinage, and with our present advancement in scientific knowledge, it is scarcely creditable to our intelligence that it should still be questioned whether the teachings of science do not conflict with the declaration of revelation; in other words, whether God's works do not disprove God's existence.

There is in the Bible a marked absence of technicalities, and that it was not written as a text book of natural science its internal evidence is full and conclusive. Had it been so written, it could have reached but a very limited number of the millions who have lived and are yet to live, and never could it have become, as it now is, a book suited to all ages of the world, and all conditions of men. Had the Bible been made the repository of all the truths of science, even we of this nineteenth century should have been unable to understand them, much less the ancient Hebrews, just emerging from a state of slavery and semi-barbarism, to whom it was given. As it has been, the first glimmerings of scientific truths have aroused persecution, as witness the spirit of intolerance, which, as late as the sixteenth century, compelled the retraction of Galileo and others. To have attempted to make the Bible other than a spiritual guide would have been, humanly speaking, to have secured its rejection, and consigned it to oblivion. But as a spiritual guide, the plan of salvation which it points out is so full and free that not even the dullest apprehension need fail to comprehend it, unless it absolutely refuses to come to the light. For those who doubt the authenticity of the Scriptures there is a test more efficacious than Prof. Tyndall's proposed prayer-guage, in that it is unfailing. Let such a doubter, determined to know the truth, and willing to abide by his convictions, go alone by himself, secure from all intrusion, and praying for light, take the four Gospels and study them as carefully and candidly as he would the latest work on his favorite science, and ere he has completed their study, or perhaps even that of one of them, that peace which truly passes all understanding will be his; and though he will be unable to formulate the process by which he has received the newly-found treasure, mathematical demonstration could not make him more sure of its possession.

The savant, who has made the study of science the one pursuit of life, as he approaches the threshhold of the grave, "and life is fading fast away," sees the vast kingdom of knowledge, whose portals he has but barely entered, stretching boundlessly before him; the span of human life is too brief to grasp all the truths of even one department of knowledge. As fully and freely as the Bible points out all that it is necessary for us to know concerning our spiritual natures, there

are some spiritual truths which our finite minds cannot grasp, and which we s never understand until they are revealed to us in the Hereafter. And shall the creatures of a day, who, with all our vaunted intelligence, can grasp but barest remnant of the domain of God's works; shall we, because of the fi ness of our minds, arraign the wisdom and even question the existence of Omnicient?

The fact that the Bible has survived the wrecks of empires and change time, and is still a growing power in the world, is evidence of its divine ori To men of rare powers we apply the term "God-like," a term for the highest sible praise. Yet where, among all the men of transcendant genius whom world has ever known, shall we find a mere man whose works have been har down from so remote a period, or have met with such universal acceptance, a Bible?

Let us look at the subject from a scientific standpoint. In the early stag its development astronomy was supposed to contradict, point-blank, the teach of Scripture, but is now conceded to enforce them. Since then, geology, the l est of the sciences, the achievement of the present century, with its apparent flict with revelation, has come to the front. But as the science becomes bette derstood these discrepancies will vanish; for what is every new discovery in ence but a new view of the Deity? How preposterous some of these alle discrepancies are, two of them, the Mosaic account of the six days' creation, the introduction, by sin, of physical death into the world, illustrate.

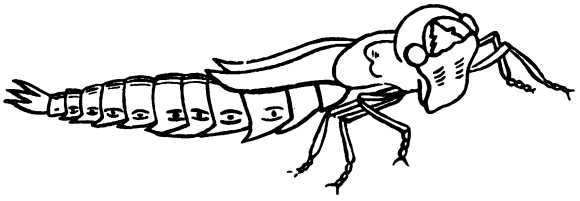
Suppose geology did not assert that more than fifty millions of years elapsed from the creation to the advent of man, what reason have we for sup ing that the six days were solar days any more than that they were lunar, or s rial days, since it was three of these "days," since the evening and the morn were the first day before the sun was set "in the firmament." How fair we it be for the future historian to say of us that we, in this year of our Lord 1 were ignorant of the barest rudiments of astronomy, because that from every senal and fort in our land was fired a *sundown* gun?

As to the introduction of death by sin: It is impossible for a momen suppose that the trilobite, for instance, which, so far as is now known, was first form of animal life to see the light, and that fully 50,000,000 years before m era, and whose fossilized remains lie entombed in the rocks at least six miles l than the first traces of man's existence appear, came under the condemnatio death, for sin. Our limestones, and the marbles with which we adorn our d lings,—as well as perpetuate the posthumous virtues of our departed friends - but little else than an aggregate of indurated remains of forms of life which isted ages before man came upon the stage. Our marls, lying in strata s times to a thickness of fifty feet, are largely composed of animalculæ so infini mal in size that a number equal to the whole human population of the globe c ed in a single drop of water. Myriads of these minute organisms and thous of other species of animal life became extinct before man's era. How shall say then that death was to them the penalty of human sin? The one them

the Bible is man's origin and destiny—"and so death has passed upon all MEN," NOT upon all the BRUTE CREATION.

Geology, rightly understood, instead of engendering scepticism, is found to be replete with proofs of the wisdom and goodness of our Heavenly Father, and of his bounteous provisions for our material wants, ages before the human race was. The one ruling purpose manifested in all the transformations and modifications which the earth has undergone seems to have been to prepare it as a fitting dwelling place for the habitation of man. Take, for instance, the carboniferous era: The earliest forms of life had been of very simple organization, but gradually rising in the scale of being we find that a few vertebrates had been introduced. The climate was probably tropical, and the atmosphere was so laden with carbonic acid gas as to be unfavorable to animal life. But then, as now, carbon was the principal plant food, and such a rank growth of vegetation as then took place has never since been equalled. The estimated amount of coal in the world is about five trillions of tons, and this vast amount of carbon must have been drawn from the atmosphere. Then comes an immediate ascent in the scale of being, and huge reptiles, from seventy-five to eighty feet in length, swam the seas, and four-footed creatures, from twenty-five to fifty feet long, dragged themselves through the marshes and estuaries. And thus it was, in Triassic Time that bipeds literally left their "foot-prints on the sands of time" by impressing them in the Connecticut Valley sandstone, then the yielding shores of an estuary of the sea. In anticipation of our forests becoming disrobed, and the sea refusing to yield us an illuminator, there was stored away for our use millions of years ago the ruddy anthracite which gives its cheerful glow to our winter evening firesides and sends the busy hum of industry through the land, and the material which lights both our busy city streets and the humblest dwelling in the remotest hamlet.

Ages passed, and there came a period of congelation, when over New England there lay a sheet of ice, at least eight times the thickness of the largest of modern glaciers. A more genial period, and this vast mass came crushing and grinding its way over the hill-tops, bearing in its onward march, boulders weighing, in some instances, thousands of tons. All this commotion was not the result of blind chance. The coal, the salt, the iron, the lime, and all the other ores and minerals had been provided for us, and now was formed the soil, from which through the medium of the vegetable kingdom we derive our food. Truly, all the works of God praise Him. If the "undevout astronomer is mad," much more is the geologist who cannot say from his heart of hearts: "Great and marvellous are Thy works, Lord God Almighty; in wisdom hast Thou made them all!"



NYMPH OF DRAGON FLY—MASK SHUT.
From Circle of Sciences.

NYMPH OF DRAGON FLY—MASK OPEN.
From Circle of Sciences.

IMPURITIES OF WATER.

T. A. FELCH, M. D.

The universal employment of water in all branches of domestic art, rei it an agent of great and acknowledged power, in influencing the welfare o human family. Constituting, as it does, the most essential element of the ar economy,—in weight no less than three-fourths—it promotes the various ph logical processes and forms the essential means by which, under existing cir stances, life is made possible, Since, then, the supply for all these purposes be introduced from without, it becomes a matter of importance that it shoul free from all impurities and deleterious properties.

And, first, it may be remarked, that the physical appearance of water i criterion of its wholesomeness, neither does a disagreeable odor or taste n sarily indicate that it is unwholsome. These last should, indeed, lead o regard the article as of a suspicious nature, and to pursue examination fur both microscopically and chemically.

Individual experience can enable each to judge of the effects of certain w in his own case, but analogy is not to be relied upon, for the reason tha judgment is apt to be influenced by predjuce or personal idiosyncrasy; ther a chemical and microscopical analysis affords the only trustworthy data on w an opinion as to the wholesomeness of any particular water may be based there are no inorganic matters which do not exhibit their characteristic reac by the former, and no solid particles which are not revealed by the later.

What, then, are the impurities at times found in water used for culinary potable purposes, and from whence are they derived? Water possesses in a degree the property of solubility, and it is this property which enables it t solve, and hold in solution, appreciable quantities of all substances with whi comes in contact. It follows, therefore, that it is impossible to find in na water which is absolutely pure, or even to render it so by artificial means, the sources of contamination are so constantly present; nor would such wat desirable for domestic uses, as it would tend rather to disintegrate than to up the structures of the body.

There are two sources from which all impurities in water must be der viz : The atmosphere and the soil. No fact has been more clearly demost than that which regards the atmosphere as the storehouse of many impurities source of much that is pernicious—though to the ordinary senses beautifully and pure, it is, in truth, filled with solid particles of matter and foreign g And these solid particles are not alone of inorganic origin, but may be mass organic or living organisms—either animal or vegetable—made visible onl the higher powers of the microscope. Water, then, falling from the clouds i form of rain, traverses a certain extent of this atmosphere, and consequently f

a solution of, or a mechanical combination with, whatever foreign matters may at that time be present, and it is a well known fact that the atmosphere is fresher, purer and more invigorating, just after a shower—when it has been *washed* of its impurities by the falling rain drops, than before the rain storm had visited us. A microscopical examination of snow flakes recently fallen, exhibited the presence of many foreign substances taken from the atmosphere while falling, such as minute bits of cloth, coal dust, etc., thus attesting to the purifying properties of both rain and snow upon the atmosphere; it is also well known that the drops falling near the close of the shower are purer than those caught at the commencment.

That all these substances, when introduced into the human system may, under certain circumstances, produce disease, there is no longer reason to doubt. Indeed a certain form of minute vegetable life, found in water exposed for a time to the atmosphere, and known by the name of "bacteria," are supposed by some to be the cause or the means of conveying the germs of certain diseases. However that may be, water containing these bacteria, or any other form of fungous growth should on no account be regarded as potable. The recognition of these is the chief function of the microscope in the analysis of water, though not the only one, for by it also, all substances not in solution are seen. However these are of little practical importance, as they are seldom in sufficient quantities or of such a dangerous nature as to exert any marked influence upon the system. That the specific virus which is the cause of certain diseases, not only exists but finds an agreeable habitat and even increases in virulence in water, is well known as instance, the poison of typhoid fever or cholera; and it is greatly to be regretted that the recognition of the disease germs is still beyond microscopic power.

The spectroscope is beginning to serve a useful purpose in the examination for impurities in water, and no doubt will be invaluable in detecting the more subtle element which might escape observation by the other methods. Its manner of application is as follows: should the water of any spring or well be suspected of contamination from a neighboring sewer or other source, then put into said sewer a solution of some highly diffusible substance, whose line is constant and easily recognized by the spectroscope. Should, now, at any time in the examination of the water of the spring, the line of such substance be present, it will establish the fact that a communication exists between the sewer and the spring, which of itself is sufficient evidence of the dangerous character of the water.

The deductions derived from a chemical examination of water are, perhaps, of even greater practical importance than those mentioned above; and chemical analysis shows that water itself is the product of the combination of oxygen and hydrogen gases in definite proportions and under certain circumstances. But other gases are present in the atmosphere and are absorbed by water, often in immense quantities. The one most constantly present is carbonic acid, and this can in no sense be regarded as deteriorating but rather as improving water for drinking purposes, as it not only imparts a brilliancy and vivacity not otherwise

obtainable, but also makes it more palatable and gratifying. Other gasses harmless nature, some which give to water distinct taste or order, or still oth an irritating quality and capable of doing great injury, may also exist, and be ing absorbed, give their distinctive qualities and constitutions to the w But it is to be remembered that where so many different substances are bro together in solution, chemical changes must necessarily be constantly t place, resulting in the formation of salts, some of which are precipitated others remain in solution. The source from which water may derive its most gerous impurities is from its contact with, and absorption of, the products of a decomposition. During the act of decomposition the organic matter become dized, giving rise to the "albuminoid ammonia,"—a most poisonous subst From the same source come acids, viz: The nitric, nitrous and phosphoric, which may exist in a free condition or in combination with bases formin nitrates, nitrites, and phosphates. It is hardly necessary to say that water co ing any of the above ingredients should be rejected for all domestic uses. this forms one of the strong points in the argument of those favoring the crem of dead bodies, and there is no doubt but that the present mode of disposi such matter has been, in many instances, productive of great and serious conducted through water alone. Meusel supposes that the nitrites may be ed by reduction of nitrates in water in presence of these bacteria, as his e ments lead him to believe.

Tissandier has obtained crystals of nitrate of ammonia by evaporating water. His explanation is that rain from a thunder cloud, is charged electricity, and every flash of lightning causes the combination of some a pheric nitrogen to hydrogen, forming ammonia, and to oxygen, forming nit nitrous acid, the combination of which base and acid produce the salt in que

The inorganic matters often found in water, may exist in such quantit to render the substance extremely unpalatable and harmful. These corre chemically with the character of the soil in that neighborhood, and are gen the salts of lime, magnesia and silica, and it is these which give to water th perty of "hardness." When present in large quantities in drinking water, may collect within certain organs of the body, forming calculi. Traces of p ous minerals are sometimes found in water in dangerous quantities.

Water is often rendered turbid by the finely divided particles of earth ter, not in solution, but simply suspended in the menstrum; and so minu these particles that repeated filterings are necessary to effect their removal. water of the Mississippi is of this character, and it is treated by those enga the manufacture of artificial ice by adding to a given quantity a mild solut alum, which causes a precipitate, and the foreign matters are carried to th tom of the reservoir, after which the clear portion is drawn off.

It is thus seen that the refreshing, life-giving water may be the means of mitting disease and death, and consequently it is of the greatest importan it be made as pure as possible; and the ordinary method of filtration accom this in a very satisfactory manner in most cases. Especial care should be that the source of the supply be near no cess-pool, sewer or burial ground, f

best of filters cannot remove all deleterious impurities, and it is of great importance that the source of supply should itself be as pure as possible, as an illustration of the bad effects of such a supply, it is said, that the water obtained in the city of Ahmedabad, in India, is so impregnated with such impurities that even garden plants die if watered with it; and in the entire city of London only three wells are in use. The presence of minute annimal life in water is not always injurious, but may to a degree be of service, for by devouring the decomposing vegetable and animal matter held by water in suspension, and assimulating the same into their own bodies, the minute infusoria act as scavengers, or a corps of health police, ever active and ever busy to serve their part in nature's economy.

Boiling will kill all living organisms, and if the product of this distillation is then passed through a filter, to remove any charred remains which may have passed over, it will give the purest water for drinking purposes attainable, but on account of this process also removing the gasses held in suspension, the taste becomes flat and disagreeable, and if left to stand for a time to absorb gases from the air, there is danger of the water also obtaining floating vegetable, animal or mineral impurities. To detect the presence of animal decomposition, make a mild solution of Permanganate of Potash and to the suspected fluid add a few drops of the reagent. Should the latter, which is of a bright scarlet color, become decomposed and decolorized the water should be rejected.

The vapors and mists constantly arising from the ocean carry with them sufficient quantity of salt and other mineral substances, together with the foreign gasses, to render the air of the seaside markedly different from that of inland countries.

Streams flowing over rocks not easily soluble, as granite, and especially if fed by melting snow or ice, are extremely pure, even more so than filtered water. To secure a sufficient supply of fresh and wholesome water during long sea voyages is a great desideratum, and is very difficult to satisfactorily accomplish.

The supply taken in at the beginning of the voyage and stored in barrels or tanks soon becomes offensive and unwholesome. Sea water is so impregnated with saline matter that it is not palatable, tending to augment instead of relieve thirst. The method usually adopted is to distill the sea water, then pass it through filters of charcoal, by which the charred organic matters, which have passed over during the process of distillation, are removed and the water thus becomes wholesome. One fact should be borne in mind, and is of great importance especially to those living in modern homes, which is, that water which passes through lead pipes or has stood in lead lined cisterns is unfit for drinking on account of the poisonous qualities of the lead taken up by the water.

Such then is a very brief resume of the leading points of this subject, a subject of such vast importance to the human race and of so extensive a range, that to give it anything like a thorough treatment would far exceed the limits at our command. But if, by this brief outline, we may have excited the interest of our readers to the importance of a pure supply of this most essential fluid, and the absolute necessity of an examination of the sources from which that supply is derived, we shall feel abundantly repaid for our labors.

THE EARTH'S AQUEOUS RING, OR THE DELUGE AND I CAUSES, BY PROF. ISAAC N. VALE, TEACHER AT WESTOWN SEMINARY, PA.*

BY J. MANFORD KERR.

This is "a new theory of the deluge" and "is entirely made up of extrac the author tells us in his introductory note to the reader, "from a larger wo entitled 'The Glacial Epochs, and the Deluge—a work chiefly geological an several years preparation, but not yet ready for the press." Prof. Vail ackn ledges that "the theory here produced antagonizes the views commonly hel scientific men," and that it is not faultless, declaring that "he *proposes* it, others may improve it, by their own investigations." He sends forth this precursor of the coming work, to ascertain the strength of the enemy and l the disposition of forces, to draw forth objections and suggestions by taking vantage of which he hopes to make the first issue of the work a revised and rected edition.

The deluge, its causes and extent, have won the attention and elicited discussion of men eminent for their piety or learning, ever since the rabbin days. But until the present, never has there been a theory advanced so novel extraordinary as is the present one in many respects. Some scientists have vanced a theory which contends that the deluge was simply a local occurre and not as extensive as the surface of the globe, as maintained by bibliolat and annotaters generally. The antipathy consequent upon this contrariet opinion, is replete with virulence and vituperation. There are some writer eminence in the theological world who ignorantly and splenetically assume it is the "deep personal sin" of the scientist that precludes the confident and questioning acceptation of their theological dogmas; and there are couspicu and authorative but polemical members of the opposition, who maintain that t who cherish the noble bible, inwrought as it has been, by unjust privation cruel persecution, with the constitution of our forefathers, and by inheritance us, are necessarially either blind or hypocritical. This is all wrong and sh not be. We should be tolerant in all things. Coercion should be removed f the mental as well as the physical man. The human intellect ever strives for tainty—for absolute truth—in all things, and is ever restive and rebellious u tyrannical and ignorant dogmatical restraint. In the enthusiastic pursuit of favorite object, it is frequently led to accredit mere conjectures as absolute tr The same inevitably results from a servile acquiesence in clerical dogmas. power of "fearlessly doubting" has been said to be one of the attributes of uine philosophy.

Prof. Vale stands enthusiastically by the integrity of the Mosaic versio creation, but finding that insufficient for the successful maintenance of his the he calls to its support evolution and *tradition*. He maintains that in the

* T. S. Hickerman, West Chester, Pa., Publisher.

history of mankind—that is, during the anti-diluvian period—this *sphere* dwelt a solitary prisoner within an aqueous incarcerating ring, *compassed* it on all sides. This watery envelope, breaking up, fell to augmenting the terrestrial seas and producing that calamitous c as the Noachian Deluge—a deluge, traditions respecting which have been *from* the rubbish of time, in Mesopotamia, and found amongst the savage tribes of the world. No trace of this old and widely diffused is current amongst the Greeks, the Semites, and the Indians, great catastrophe and its surviver, who was preserved because of his ary piety and holiness, and who became the father of the race with earth was repeopled, is to be be found amongst the Romans, (*Vide* I, *p.* 53).

"In His plan to prepare the earth for the habitation of man," author, "God said 'Let there be a firmament in the midst of the waters, divide the waters from the waters.' We understand by this expression primeval ocean was to be divided into two or more parts by the (*Sic*),—[Adam Clarke says *rakeia*]—or firmament, which means simply * * * 'God called the firmament Heaven; and since the itants could recognize only these three things, viz: the earth, the seas sky that surrounds them; and since their earth and their seas, were the our earth and seas, their firmament must have been the same as our sky phere. * * * * * * * It is therefore eviden firmament was the atmosphere, and it was so applied by the ancient There is no word in the Hebrew language distinguishing the the rest of the expanse above, whence it is evident that the Hebrews such distinction. The firmament they considered to be an expanse earth, and beyond it was a great fund of waters; and the expression above the firmament' means the waters above the atmosphere."

"How are we to understand that a mere expanse, or body of air, come a partition between two bodies of waters, one situated *above* and *below* it?" This question, like the much perplexed question of the which this one is introduced to explain, is difficult of solution. The explanations are hardly reconcilable with scientific law—or, perhaps, it a nearer approximation to truth to say that the arguments he adduces are ficient to support a scientific theory, whatever they might do for a clerica He says, "Since then, we have the plain declaration of Scripture that waters above and beyond the firmament, since we see water so placed surface of planets, [Prof. refers to Saturn and Jupiter, upon whose cal condition he has expatiated, calling evolution to the assistance of support of his theory], and since such bodies of water must revolve central body, I claim that the earth in antidiluvian times was large belt of waters. *That it was visible to the first inhabitants as the* waters *falling to the earth.** The waters originally formed an and

* The italics are our own.

great laboratory, the primitive earth (*Sic*), skirted the bounderies of a
remarkable atmosphere with which the chemist, the geologist, and the
astronomer, are familiar. Well, such an object must have had a n
hat the waters on the earth were called *seas*. The alone remaining Hel
which could refer to the waters, we render the 'Great Deep.' *It is so c*
ALL MANKIND *formerly believed that the clouds were* FED *from above.*
whole range of ancient writings, both sacred and profane, abundantly p
So thoroughly were the Hebrews impressed with this belief, that we find i
of mankind thousands of years after the Great Deep had fallen to the ea
If we confidently acquiesce in this artless theory, accepting all its legiti
another much vexed question—that of the bow, which our au
speaking of is a sign, "touches not that which ordains it an eml
Infinite Mercy, but its significance as connected with the fall of the water
for ever at rest.

The conditions absolutely indispensible for the formation of a bow, are t
number, to-wit: (1) Falling water, it matters not whether the drops of w
precipitations from a passing cloud (from above *rakia*), the spray arising
cataract, the mist flung from a rapidly twirled broom, or the drops, spray
repelled by the paddle-wheel of a steamer, provided only the ray of
through the sphereules of limpid liquid at the the requisit angle. A ra
passing through the center of the sphere, its course being in an axis o
is neither refracted nor reflected; those passing through parallel with
AXIS, will be refracted more or less towards, in proportion to their distance fron
AXIS, but so as to fall in decreasing degrees, upon the inner surface of the drop;
those rays falling upon that portion of the surface of the drop lying between
and 90° from the axis, will be sufficiently condensed, reflected and refracte
form a compact circular beam, and become visible. Rays falling upon other
tions of the surface, and at different angles, are reflected, transmitted, and refra
so irregularly that they are diffused and feeble, making no, or but a slight, im
sion upon the optical nerve. (2) The second condition requisite for the form
of a bow, is unimpeded solar light. This light may proceed directly from
great luminous centre of our solar system, or may be reflected rays from the
surface of the receptive moon; in the latter case the celestial phenomenon i
nominated a lunar-bow or moon-bow. (3) The third and last condition requisit
the *appearance* of the bow, is a terrestrial eye to behold it, for without an intelli
organism there could no more be a bow than there could without either water or l

Conceeding that a 'Great Deep' dwelt beyond *rakia* in past diluvial ti
it inevitably follows that this aqueous belt shut out all solar light, and wra
the earth in cimmerian gloom. If all solar light was excluded, no matter
quantities of water fell there could be no bow, because one of the esse
elements was wanting. When this aqueous envelope broke up and was pr
itated to the earth, the water cloud which had hitherto intercepted the sun's
beyond *rakia*, was removed, and this orb shone forth with all his wonted
liancy and magnificence, thus rendering a bow possible.

But the theory labors under difficulties which, unless satisfactorily explained, prove fatal. An appeal to Genesis, the primal basis of the theory, subverts said theory. Since the author rests his theory on Genesis, Genesis is competent evidence to overthrow the same, no matter though it may he considered non-historic and non-mosaic, no matter though it be pretty generally believed by those who have taken the trouble to qualify themselves for an enlightened opinion upon the subject, that the whole Pentateuch was written by Ezra, coadjutated by five others (*vide* Esdras, Ch. 14) and was compiled, a portion of it at least, from Assyrian legends. That the earth was released from the gloom of its aqueous prison prior to the creation of man, is evidenced alike by Genesis and science. In the first chapter of Genesis we are informed that God separated the light from the darkness, calling the light day and the darkness night, prior to the creation of man. The testimony of science will be adduced in the sequel. Again, in Genesis III-17, in the sentence of Adam for his transgression in the garden, we read: "Cursed is the ground for thy sake, in sorrow shalt thou eat of it *all the days* of thy life." There cannot be the remotest shadow of a doubt that the word "days" here refers to the succession of light and darkness — the periods of labor and rest. Now, if there was such a successive alternating of day and night — light and darkness — it is evident that the aqueous envelope which the theory supposes to have hung upon the outskirts of our atmosphere (*rakia*) like vultures over quarry, must already have been broken up and precipitated to render such an alternation possible, *ergo* the great flood caused by the fall of this ring occurred *prior* to man's appearance upon the stage, and consequently can not be properly identified with the Noachian Deluge, which is presumed to have occurred *since* his appearance.

Did such an envelope of water in reality ever exist?

Why, all mankind formerly believed there did, and so thoroughly was the Hebrew mind imbued with this idea that it remained a traditionary belief among mankind for thousands of years after the Great Deep had fallen to the earth. "The whole range of ancient writings, both sacred and profane, abundantly prove this." Certainly this is the most conclusive evidence that has ever been adduced for the support of any scientific theory. What power is there, in heaven or on earth, that can withstand the force of an argument founded upon the traditionary *belief* of mankind in an ignorant and superstitious age, or in a brutal and barbarous nation! Certainly it is at least as incontrovertible, if not as plausible, as that theory of the ancient naturalists, in which it is maintained that heat is nourished by the humidity of night (*Macrob., Sat.*, 1, 2, 3.)

Traditionary belief is a secure foundation upon which to build. There was an ancient race who cherished for centuries a firm belief in, and exultingly boasted of, a direct descent from the sun (*Indian Antiquities*, Vol. 1, p. 16, Ed. 1792.)

The Romans — a classic nation for many things renowned, the literature of which has secured perpetual position in the curriculum of the youth of all civilized nations — believed when they saw the clouds drifting along the sky that the hounds of the gods were collecting the scattered cows of the herd; when they heard the thunders roll amongst the mountains, saw Zeus brandishing his bolts on

Olympus; and when the cerulean blue smiled above them, gazed into the eye Athenæa; the husbandmen invoked spirits of fallowing, ploughing, sowing, rowing, and so on down to the in-bring, up-storing, and opening of grana implicitly confiding in their gods, never fearing that their prayers would no answered, and considering it heinously sacrilegious to doubt or question the po of the gods to grant their requests (1. Mommsen, 52.) The historian of *Comitia Tributa* tells us that when there had been thunder or lightning (*si toni aut fulgurasset*) so great was the superstition of the people that the *Tributa* co not be held that day; for it was a rule from the beginning of the republic, *fulgente, cum populo agi nefas esse* (when it lightened it was unlawful to transact lic business.)

The universal faith of man, coadjutated by the bigotry and intolerance of norance, forced Galileo—whose heinous crime was the promulgation of the trine of the diurnal and annual motions of the sun—with all the solemnit religious mockery—to abjure, curse, and detest, because "erroneous, hereti and contrary to Scripture," but the truth of his *E pur se mouve* has triumph over ignorance, error and fanaticism, utterly confuting the "universal faith mankind," and establishing the correctness of the persecuted philosopher. same damnable coalition burnt Bruno at the stake for advocating the helioncer theory and other doctrines which now rest secure upon the adamantine founda of scientific ascertainment.

We think that there was a time when the earth was inclosed with in a p cel of water, but we do not think that the "faith of mankind" is proof adeq to its establishment. Let us appeal to science.

Go back to the time, if *time* it may be called, when nothing but God exi and all else was void chaos. Then the whole material universe was diffu throughout space, as far as the utmost line that bounds imagination's flight, gaseous, nebulous gathering. In this world-mist nuclei were formed; by w means we will not stop to inquire. Given the nuclei, the circumjacent wo stuff would seggregate around them. This seggregation inaugurated a rotary tion in the forming spheres. Each of these nuclei became the centre of a s system. Our sun is the remnant of the sphere which once embraced within enormous periphery the orbit of the far-distant Uranus, and the matter of all planets which compose our system. The rotary motion being once inaugur would be accelerated by the refrigeration of the superlatively heated mass.

With the inauguration of this rotary motion two antagonistic forces were veloped, centripetal and centrifugal force — the one attracting towards, and other repelling from, the centre. As long as these forces remained equivalen the centripetal preponderated, the sphere continued its course an uninterru unit; but as soon as the centrifugal gained the ascendancy there would be a p pherical detachment. This detached peripherical ring, because of its inequ of density, would have its continuity broken up. While the detached ring tained its original annulation it would revolve with the sphere from which it detached with the same speed the sphere possessed at the instance of severa If the annularity be destroyed because of inequality of density the detachm

will be gathered into one or more spheres, which will revolve round the parent sphere with the speed of the ring of which they were formed; i.e., with the speed possessed by the surface of the earth at the time of the detachment of the ring to the rupture of which they owe their origin.

The spheres thus formed threw off a ring, which ruptured and formed new spheres. This process was continued until the refrigeration prevented further detachment. Some of these secondary planets threw off one or more rings which ruptured and formed satellites, revolving round their parent mass. Our earth threw off one peripherical detachment, which ruptured and formed her moon — a companion planet accompanying her in her annual journeyings round the sun. After this detachment the surface of our globe became too rigid to permit of another detachment.

During the early career of the earth it existed as an incandescent mass — a ball of fire. During this period the intensity of the internal heat was so great that all of the constituent materials which are capable of fusion were repelled into space, while the more volatile were repelled into the utmost confines of *rakia*. As refrigeration progressed the elements would be confused; the heavier first, and the most volatile last. After the condensation and precipitation of the clorides, followed the condensation of the aqueous element, which had heretofore existed as an attenuated and invisible vapor—invisible even if there had been an intelligent organism situated upon the surface of the incandescent liquid sphere to behold it.

The aspect of nature has undergone a change. First, whisps of *cirrhi* swept along the unobstructed sky; these deepened into dark and portentious *nimbus*. At this time the earth was completely incarcerated by a circumambient wall of water; but this was before man or any of the land or marine animals or plants had come upon the scene; the intensity of the heat of the globe precluded the possibility of their existence.

The conflict between the two elements—fire and water—waxes fierce. The over-burdened cloud descends in an unbroken sheet, but ere it has reached the surface of the globe is scorched to evaporation by the intensity of internal heat, and returned to the bosom of the cloud only to be re-precipitated and re-evaporized. Finally the hosts of Neptune prevail over the forces of Pluto, and the whole realm of the former is precipitously transfered to the territory of the vanquished potentate.

This was accomplished while man as well as the balance of animal creation slept securely locked in the great germless store house of futurity. Long ere man or any of the land animals had made their appearance, the globe had lost by far the greater portion of its surface-heat, and old ocean had grown venerable with the restless ravages of ages.

That "the earth in antediluvian times was surrounded by a huge belt of waters," we do not doubt; but that that belt "was visible to the first inhabitant as the last remnant of waters falling to the earth," we do doubt, because we think it an error of assumption incompatible with scientific law, and not required by 'Biblical' cosmogony.

COMMUNION WITH NATURE.

To the æsthetic mind nothing can give more real pleasure and delight t "sweet communion" with nature; to roam amid the forest glades; to listen to moan of the wind as it sighs through the boughs of the trees, or the music of zephyrs as they gently toy with the leafy canopy above us, or play with the wa branches of the elms; to wander alone among the wild woods, to listen to natu music, the song of birds, the hum of insects or the rustle of the leaves; to in the peculiar odors of the woodlands and groves; to watch the play of the li and shades; to note the mingling and ever changing tints of color as depi in the passing clouds, the depths of the dark forest aisles, and the open su glades, or to watch the graceful flight of birds, or the gambols of the squirrel they leap nimbly about the trees or along the rustic fences. Such simple q scenes give more real satisfaction and lasting comfort to a mind toned to ap ciate the beautiful, than the most studied and elaborate of the works of art.

Nature has strewn this world with beautiful beings, and has embellished earth with an endless variety of wonderful and exquisite forms; she has cov the ground with a carpet of the softest green, concealing the rough inequalities smoothing over the ragged edges with a loving hand; she has scattered lavish profusion, beauties everywhere in unbounded benevolence; she has rounded us with curious and elegant objects to entice us to study and profit her works. Everywhere we find lessons of wisdom, beauty, peace and o placed before us to tell of a loving, tender and beneficent creator and preser

By companionship with nature we become more tender and loving in sentiments; our baser natures and harsher and rougher passions are subdued, we become enlarged and enobled in mind and feelings; all the pleasing sights sounds become anodynes for grief and sorrow; the simple chirp and hum insects, the song of birds, all exercise a soothing effect upon the mind.

In sound as everywhere else nature has a never ending inexhaustable vari every scene and locality has its peculiar voices; the sounds one is accustome hear in a forest are unlike those we hear on the ocean. Here the rustle of leaves, the creak of the boughs and twigs are replaced by the roar of the surf, the song of the wood warblers is replaced by the shrill cry of the sea birds; echoes of the mountain gorges, hollows and ravines, are never heard upon the plains; a gurgling mountain stream is suggestive of cool retreats and frag sylvan scenes.

The influence of nature upon the character of the human race is very gr Those living in the rugged mountain districts partake of the strong, rough, and lofty nature of their homes, and have a deep love for freedom, a great po of physical endurance and much energy of character, while those inhabiting plains and level countries are not so rugged or independent in their natures, are more peaceful and placid in their pursuits, and lack somewhat of that en and ruggedness of character possessed by the mountineers.

But it is not alone in the voices of nature that we can trace the individuality she has bestowed upon each locality; she has stamped every place with its peculiar marks. The difference in colors, tints and shades are appreciable to a great extent in different situations, so also are the odors with which the air is loaded. The lights and shades depicted in a forest or woody landscape are unlike those seen upon the ocean, so too are those in a rocky, rugged mountainous region, and distinct from all, are those we will see upon the hot sultry desert. The air of the sea shore is markedly different from that of the interior. The landscape—the tints and shades of an artic scene, with its glittering icebergs reflecting in the sunlight all the colors of the rainbow, with its snowy fields and clear atmosphere, are in marked contrast with the rich and deep colors, the warm lights and gorgeous tints of the luxuriant tropics. The mountain regions, with their foaming cascades and roaring torrents, their snow-capped peaks and deep dark gorges, their bare rocky hillsides and moss-covered stones, are contrasted with the waving meadows, rippling brooks, smooth and gently curved outlines of the plains, where the cattle stand in the placid streams, and the hum of industry is contrasted with the scream of the mountain eagle or the fall of an avalanche. The boundless expanse of the prairie with its waving grass or its green carpet bespangled with many tinted flowers, where the scene is only bounded by the distant horizon, will at once strike the dweller of the mountain with wonder and surprise.

Thus has God given man an almost endless variety of scenes, all having their peculiar characteristics of beauty, grandeaur or utility.

But it is not alone in the characteristics of the surface of the earth itself, or of its concomitants of verdure or colors, that we are delighted and enticed into a deep and absorbing love; the world is filled with a teeming, busy and wonderful life, we are surrounded by myriads of strange and interesting beings, almost every leaf, every drop of water has its peculiar inhabitants, and each of these beings has a strange, interesting life, an individuality, a history of its own, a wonderful tale to unfold; the humblest insect that crawls unseen and unheaded beneath yonder tiny leaf which we were just crushing beneath our careless foot has a peculiar and wonderful history to unfold, full of absorbing interest; it has its loves and hates, its battles and triumphs.

Let us then profit by all this wonderful life scattered with so lavish a hand around us; let us not go through the world unheeding the symbols of God's wisdom and love strewn before us, but let us profit by them, and we will be richly repaid for the investigation. Around our homes, at our very doors is abundant material for a *life's work*. The little moth that flutters around the evening lamp, the humble and despised spider that crawls loathed and abhored upon the floor, each has a tale of wonderful interest to reveal; a story of a strange life of singular changes. Nature is indeed a book of absorbing interest, which will drive away ennui, a cure for all "blues" and a teacher of all that is ennobling and improving, a book that is ever open for our inspection. A walk in fragrant forest glades, where the leaves form a canopy of waving green over our heads,

which shuts out the sunshine and forms a shady, cool retreat in summer, w
far from the noise and bustle of busy life we may wander alone, surrounde
the various free, untrammeled creatures of the woods, and observe their inno
lives and their wonderful habits, can but both interest and instruct any one
possesses a sensitive mind, atoned to appreciate the beautiful and wonderfu
nature.

ON SOME REMARKABLE AND SUDDEN FLUCUATIONS I. THE WATERS OF INLAND LAKES.

It is well known, and has been the subject of inquiry and interest, from
earliest settlement of this country, that the waters of our great lakes are subje
sudden and great fluctuations in their level; and this change in the level of
waters seems not to be dependent upon or the result of, any storm or chang
the weather or to be caused in any manner by winds or other known phys
causes. Many instances are recorded where the waters of these lakes have
denly risen and washed in upon the land in a great wave, when the day was
fectly calm and clear and the lake smooth and tranquil; these occurrences
moreover seemingly temporary and somewhat local in their effects, the waters
ceeding leaving the surface of the ground bare for a brief period, and then w
ing in and covering their former bed and a much larger extent of surface of gr
than before, for another brief period, and at last after two or three such alter
recessions and advances of rise and fall subsiding to their former and normal
dition, the whole phenomena not occupying more than from five to ten min
as a general rule.

In 1874, Col. Charles Whittlesey gathered a mass of observations of t
singular and sudden rising and falling of the waters of the American lakes, w
were published in the proceedings of the American Association for the adva
ment of science, from which we make copious extracts:

LAKE SUPERIOR.

(*a*) In 1789 Alexander Mackenzie was at the Grand Portage on the n
shore opposite Isle Royal; and states that "there was a sudden fall of the w
equal to *four* feet, which soon returned with a rush, and continued to vil
several hours."

(*b*) Whitney and Foster's Geological Report Upper Peninsula of Michi
pages 48–53. In the summer of 1834, the water above the falls, at the Saul
Mary, in a calm day, suddenly fell two and one-half feet, and in half an
came surging back with great velocity.

The same thing happened, at the same place, in 1842, below the falls;
current of the river rushing rapidly up stream, towards the cataract.

(*c*) Dr. Foster's statement. "In August, 1845, coasting in an open l
between Copper Harbor and Eagle River, we observed the water to rise up a fe
of a mile to the northwest, to the height of twenty feet. It curled over lik

immense surge, crested with foam, and swept towards the shore, diminishing as it advanced. The voyageurs paused on their oars, having first headed the boat so as to cut the advancing wave. It passed without doing us any injury, succeeded by two or three swells, spent its force on the shore, and the lake resumed its wonted tranquillity."

The lake was calm, with clouds at the northwest, indicating that different currents of air were moving in opposite directions.

On the same page are other observations of Dr. Foster, upon the sudden flow and reflux of the waters in 1847–8–9, which preceded or followed storms on the Lake.

(*d*) In November, 1851, at Copper Harbor according to Mr. D. D. Brockway, the water rose suddenly, in a perfect calm one foot three inches, at another time two and one-half feet.

(*e*) *Lake Superior News*—Sault St. Mary, July 17, 1855. "About 9 A. M. of the 16th the water rose rapidly in the canal, eight inches, light breeze, northwest. In ten minutes fell fourteen inches, the depth of water on the mitre sill being then thirteen feet. At 11 A. M. it had fallen to ten feet nine inches, in all *two feet two inches*, rising and falling until 4 o'clock, P. M., when it resumed its previous level. The wind changed during this period, from nortwest to southeast."

(*f*) *Superior City Times*—September 22, 1865. *Ebb and flow of the waters.* "Between half-past 12 and 1 o'clock, P. M., Sept. 17th, by our tide gauge, the water of the lake fell twenty-five inches, and within fifteen minutes rose twenty-five inches above the previous level, making *fifty inches change* in fifteen minutes —wind strong from northwest "

LAKE MICHIGAN.

(*a*) When Father Andre was on Green Bay near the Menominee River, in 1670, he says, "the weather being calm, we left our canoe afloat, and on the following morning found it on dry ground, at which we were the more surprised, because the lake had long been tranquil. The ordinary rise is one foot and the highest *three feet*, but this was accompanied by a northwester."

(*b*) *Milwaukee Sentinel*—Apr. 14, 1858. "Shortly before noon on Thursday last, a wave came rushing into the river from the lake so strong, as to upset the Ferry Boat on the Menominee.

The water which, just before the fall, was within three feet of the warehouse floor at Kelogg and Strong's pier, retired rapidly, leaving dry ground under the building. In about twenty minutes it returned in two waves, rising so as to force up the floor of the warehouse, and flow into the cellers, at the lower end of Huron street. After a few minutes, it returned to the old level. The difference in half or three quarters of an hour was full *six feet.*"

LAKE ERIE.

(*a*) Col. Bradstreet's disaster, which occurred on the 19th or 20th of October, 1764, near the place mentioned below by Mr. Taylor, appears to have been due to a sudden rise of the lake, which was followed by a severe storm.

(*b*) Mr. Taylor, an old settler of Rockport, Cuy Co., Ohio, states th 1811, about three miles west of Rocky River, on the south shore of Lake I during a calm hot summer day, he saw a white crested wave approach ra towards the beach. It carried a barrel of salt several rods, over what had l dry ground into a ravine.

(*c*) *Memoirs New York Literary and Philosophical Society, vol. 2 p.* 1. O 10th of May, 1823, according to De Witt Clinton, at Otter Creek on the Ca shore of Lake Erie, when the water was calm, a wave came in shore, nine high, rolling over the beach into the woods. A schooner of thirty-five tons thrown upon the land. The same thing occurred at the same time at K Creek twenty miles distant.

(*d*) *Black Rock*, Dec. 16, 1867.—A strong gale from the east caused waters to recede until that part of Niagara east of the Island was nearly dest of water. Below Niagara Falls the water fell twenty feet.—*Corr. New Tribune.*

(*e*) A correspondent of the "Cleveland Herald," in the spring of 1866, w that "in the spring of 1830, Mr. Luther Winchell, a resident of Lake Co., (and three others, were fishing at Madison Dock, Lake Erie. The day was p ant, no wind stirring, the lake entirely smooth, with no wave or ripple. W rolling up their net they were struck by a wave with great voilence, thro them six or eight rods inland.

Mr. Winchell was taken by the swell and borne upon its crest several striking a heavy stick of timber, which lay endwise to the lake, as it was r by the wave. Running along the timber and jumping off, he found the w over his head. He reached the shore safe, but one of his company was c under the timber, and materially injured. There were *three waves* or swells first rising fifteen or twenty feet. The succeeding ones were less, and the w soon regained its former level.

(*f*) "An old settler relates that in 1844 or 1845, at the mouth of E Creek, Cuyahoga Co., in quiet weather, a wave fifteen feet high, came into creek suddenly, carrying everything before it."

(*g*) By Col. Stockton's water registers kept at Cleveland, at 4 A. M., Nov 1845, the water suddenly fell two feet eight inches, high wind from southwe

(*h*) *Toledo Blade*, Dec. 5, 1856.—"On Tuesday last the water rose here *feet*, the wind being at the northeast. On Wednesday the wind shifted to s west, or directly opposite, when the water fell from morning to afternoon as n below the ordinary level, causing a change of *ten feet.*

LAKE ONTARIO.

(*a*) *Rochester Democrat*—June 15, 1872. "On Thursday of this week, eral gentlemen and their families were at Charlotte (mouth of Genesee River a day of fishing; while taking minnows at the East Pier in about two feet of w their boat suddenly grounded, and they were surrounded by a sand bank. short time the boat was afloat, and dashing about in the water. About tw minutes after it was grounded again. The party now set themselves to watch

tidal wave. For about *ten minutes* the water receded, then began to rise, and so continued to ebb and flow, till they were driven away by a squall from the east, about half-past five, P. M. The water rushed over the beach, about five rods above the calm water line, and then retired ten rods below the same line. At the steamboat landing it rose *twenty-two inches*, carrying boats, floodwood, and logs, out into the lake."

SENECA LAKE, NEW YORK.

(*a*) *Geneva Gazette*—May, 1855. "During the whole of Wednesday and yesterday, the waters of Seneca Lake rose and fell, in space of time varying from *ten minutes* to half an hour; five inches to *two feet* through both days. A friend of ours made a measurement first after sundown, Wednesday. It fell *sixteen and one-half inches* in fifteen minutes and then rose again."

Similar agitations of the water have been observed on Lake Geneva in Switzerland.

In Peru, according to Von Tschudi, at Callao, in 1841, "About two o'clock, P. M., the sea flowed from the shore with greater force, than in the strongest ebb. Ships farther out were left dry, which is never the case at ebb tide. The alarm of the inhabitants was great. The sea instantly rushed back with increased force. Nothing could withstand its fury. There was no commotion of the earth nor any marked change in temperature."

The cause of these fluctuations in the level of the waters is yet the subject of conjecture and surmise. Various theories have been advanced to account for them. It has been suggested that the Great Lakes are supplied and fed by subterraneous springs situated at their bottoms. By others they are supposed to have underground connections—immense rivers—with Hudson's Bay or the great inland lakes of British America, as Great Slave Lake, Great Bear Lake, etc.; that they have also an underground subterraneous outlet through Wisconsin and Illinois into the Mississippi River. To this last theory its advocates point to the fact that some of the numerous deep and clear lakes of Minnesota and Wisconsin have at certain periods of the year sudden risings and fallings corresponding to those observed in the Great Lakes. That fish, *only found* in Lake Superior and Michigan, and *there only known to live*, are occasionally discovered in the waters of these smaller inland lakes, into which they could by no possible means have found their way except by means of some underground connection between them and the Great Lakes aforementioned.

Then again it is argued that the amount of water received into the Great Lakes is much in excess of the amount capable of being discharged by their outlets, and the surpluss, taken up by evaporation, yet the level remains stationary. There are abundant evidences that in former ages the lakes Superior and Michigan occupied a higher level than at present, and *had an outlet* running south towards the Mississippi River. Sand beaches and ridges some distance inland mark the outlines of the former and ancient beaches, while wave marks upon bolders and inland banks show the course or the former outlet, long since dry.

The sudden outflow of the subterraneous springs or a sudden inflow o underground inlet from the British lakes or Hudson's Bay would perhaps e the sudden rise of the waters or inflowing wave. Yet it must be confessed such an influx of water would hardly account for all the phenomena as obser It is a subject of vast interest and we hope it will be fully investigated.

POPULAR FALLACIES.

The ignorance of the masses of our people is frequently not only the cau much inconvenience, but often of absolute distress and anxiety. The secret Nature, if sought out and correctly interpreted, reveal much that is wonde and the story it unfolds is full of tragedies and absorbing interest far exceeding most fascinating novel. We are placed in a world teeming with life, with derful creatures each of which is endowed with personal characteristics, and reveal a tale of wondrous and entrancing interest, should we only take the tro to investigate. We can not ignore these beings by which we are surrounded: are brought in more or less intimate connection with them every day of our l and they all have an effect, greater or less as the case may be, upon our exist for good or bad. The book of Nature is open; its pages are spread before then for our own benefit, our pleasure and our health, let us investigate living teeming world around us.

Many really harmless and innocent creatures, on account of some decep personal appearance, or of utter ignorance alone, who are really of great be to mankind, are supposed to be hurtful, and are shunned and destroyed, wh their true nature were known, they would be spared to render us their quiet, si unthanked, but nevertheless incalculable services, and fill the place assigned t in the economy of Nature.

Our own senses are often at fault in estimating the physical effects of world around us, and by depending implicitly upon these we are apt to be m as to the presence or absence of, or the degrees of heat, light, sound and e The senses were probably never intended unaided, for scientific investigation the eye were so constructed as to detect the minute atoms and microscopical be which now are unseen; if by it we could detect the invisible population of yo plant, it would be useless for the grosser purposes of life to guide us in our w and to detect dangers surrounding us. Then, also, if the hand were constru like a delicate balance to weigh appreciably the feathery sunbeam, like the cate instruments of the scientist, it would be useless to the merchant or lab Therefore, instead of being supplied by nature with such intricate and del instruments, we have been given reason to construct the requisite aids whi rightly used, will reveal to us the wonders concealed from the unaided eye.

As an illustration of the fallacy of the senses, the sense of touch utterly us in the discovery of the quantities of heat possessed by bodies; and of the com ative weight of subjects If we take a body in each hand of different weights

nearly equal, we are unable to decide which is the heavier, or whether they are exactly equal or not. So if we touch two warm bodies it is frequently impossible to decide the difference in heat. So, too, ice-cold water to the touch appears as cold as ice itself, while it is well known that ice water possesses much more heat than ice itself. Also, if we touch various articles in a room where everything is of the same temperature, some will *feel* much colder or warmer than others. If we touch a woolen garment it will feel warmer than the marble slab; the plaster on the wall *feels* colder than the woodwork immediately adjoining, when both are really and in fact of the same temperature, for the reason that the marble and plaster absorbs—conducts—the heat from the hand more rapidly than the woolen and the woodwork. But it is not only in the case of latent heat that the sense of touch is deceptive. It is a fact that different bodies are raised to the same temperature by very different quantities of heat, and this the unaided sense of touch fails to reveal. If mercury and water both at the same temperature are felt they will appear of equal warmth. Now, if they be both raised again to an equal but higher temperature, they will once more appear of the same temperature, and the inference would be that equal quantities of heat must have been communicated to them, while on the contrary the water has absorbed more than *thirty* times the amount of heat that has been imparted to the mercury. Therefore, touch completely fails to discover the quantities of heat which is added to different bodies to produce the same change of temperature.

If on a hot summer day we descend into a cave, the atmosphere of the cave feels cold, while if we descend again into the same cave on a cold wintry day, the temperature appears warm, when in fact the thermometer will show that the temperature is always the same in the cave, winter or summer. So, also, when we take a bath, the water, although it may be of the same temperature of the air, feels much colder. A linen shirt feels colder than a flannel one yet they both are of the same temperature. The sheets of a bed feel cold and the blankets warm, although all are of the same temperature. All these examples are explained on the principle that the better a conductor of heat a body is the colder it appears to the touch, because it draws the heat from the body. Any object which is a good conductor of heat, if at a lower temperature than the body (96°) carries off the heat from the body rapidly, and therefore feels cold. But if the same object has a higher temperature than the body it imparts its heat to the body as rapidly, and therefore feels hot to the touch. But a bad conductor of heat imparts or carries off heat very slowly, and therefore when it is at a lower temperature than the body it does not appear to be colder, and when at a higher temperature it is not felt to be warm. A carpet being a bad conductor of heat appears warm to the feet, while an oil-cloth or a board floor being good conductors, feel cold and impart a chill to the foot when brought in contact therewith.

A frequent source of illusion is presented in the appearance of the sun and moon when near the horizon, either setting or rising; they then almost always appear to be much larger than when at the meridian. Now, the real truth is that they are of exactly the same size when at the meridian as when near the horizon,

but the apparently immense size of the disc is occasioned by a mental miscal tion, if we may so call it; for when near the horizon they appear appare close to familiar earthly objects by which we can compare their real size, suc houses, trees, etc., but when seen in the clear, unobstructed vault of the hea where they form only a point in the Great Expanse, they appear so far off with no familiar earthly objects near that we cannot conceive of their real When near the horizon the mind is impressed with the immense distance of moon or sun, and its large size in comparison to the familiar objects near i the earth, which also gives rise to the apparently enormous size of its disc, wh we examine it we shall find that the sun and moon appear really of the same when in the meridian as at the horizon; for example: If we prepare two sti parallel to each other in a frame, and hold them far enough from us so that thread will just touch the upper side of the moon and the other thread the l side. Now, if we will take the same frame and try it when the moon is in meridian we will find that the two threads will just touch the lower and u sides of the moon as before.

Many popular fallacies are current in regard to the animal world, or few of which can be noticed here. It is a common notion among unedu people that if a horse hair is placed in water and there left for a time it wi process of time, become a snake. Nothing is more ridiculous. It prob arose from the existence of a species of small snake which somewhat resem a horse's hair. A real horse hair can never become a snake, no matter operated upon. Another popular fallacy is that dragon flies are dangerous can sting a person. They are perfectly harmless. Another is that toa handled, will cause warts to grow upon the hands; and another, that a speci ear wigs are accustomed to crawl into the ears, and from thence into the b causing unknown pain and perhaps *death*. It is needless to say that all beliefs are groundless and unfounded.

A very common belief is that the ticking of the little death watch, a s beetle accustomed to bore in dead or decaying wood, is the sign of the approach of death in the family where heard. Nothing could be more ridic —that a death *might* occur after a death watch was heard, of course, can n denied, but that the death watch is the cause, or has any effect upon the liv human beings, or is a precursor of death, is emphatically denied. Many h lesss snakes are killed, some people believing that all snakes are poisonous. too with our birds; far too many are killed or driven away out of ignor Few birds are hurtful. The crow and raven do far more good to man than h For every grain of corn or wheat, or every particle of fruit, destroyed they *thousands* of injurious insects, repaying the farmer a *hundred fold* for the amount of his products they appropriate. The robin, all thrushes, the fly c ers and warblers, the swallows and snipes, and the great tribes of finches larks are absolutely harmless; but not only are they harmless—they are pensible helps to mankind, and are his best friends; without them the would soon become a desert; noxious and injurious insects would increa

rapidly, if it were not for these little, untiring, vigilant police, that no vegetable production could live; no trees, no fruit, or plant, could exist. Let us, then, spare the birds and do all we can to prevent their useless and wanton destruction.

A very common source of popular fallacy is that of optical illusions, caused by the effect color has upon the eye. If we put a red wafer upon the surface of a white wall and after looking upon it for a time turn our eye to the wall a short distance from the red wafer we will see a perfect image of it, but it will appear blue; so will the white sparks of a rocket appear blue if accompanied with red ones.

If we shut our eyes and cross the fingers of one hand upon the table, and a marble is rolled between them, it will appear as if two marbles were brought in contact with our hands.

A great many supposed miraculous occurrences are explained by the predisposed state of the mind in favor of them, or, in other words, mental expectancy of the results which will be supposed to ensue. Thus, if a person has been led to expect a certain occurrence will transpire, on the performance of a certain action, he is placed in a peculiar state of mind, a mental prepossession, or expectancy favorable to its occurrence, and is misled by what actually transpires, and gives the real facts a false interpretation; for the senses are, to a great degree, slaves to the mind. The imagination has a very strong control over all the senses, and frequently real facts are misconstrued by this predisposed state of the mental powers.

Thus a real state of ill health is often brought on by the working of the imagination, so far sometimes as to cause serious results. Then, too, those possessed of disease have not unfrequently been cured through the workings of imagination by the simplest remedies or no remedies at all. It is a well-known fact that so strong is the power of the mind over the body, that the really sick have been cured by the mere repetition of a few "magic" words, when no other remedy was used. It is also a well-known fact that believers in table moving, having their minds predisposed to a belief that it is going to move, of its own free will—involuntarily exercise their muscels and thus move it themselves. Thus it depends in a great measure upon the state of the mind at the time we witness an action *how* it appears to occur to us. Also what we are accustomed to believe is a fact, or what we wish it to be, will often be thought to actually occur or exist. Science itself is embarrassed and encumbered by this "prepossession," or predisposition of the mind for certain facts or occurrences. Thus, if an author expects or desires a certain phenomena or a certain class of occurrences to transpire he looks upon the facts with an encumbered eye and as prejudiced for just such occurrences, and the story he tells is apt to be colored that way.

H.

REVIEWS AND LITERARY NOTICES.

We have received a copy of the State Geological Survey of Alabam 1875, from Prof. Eugene A. Smith, State Geologist. It abounds with intere imformation, giving first, a general outline of the Geological formations of State, then follows a Historical account of mining in Alabama since 1853 account of the Geological features of the fields and character of the coals, a of coal plants by Prof. Leo Lesquereux, some remarks upon the geological tions of the coal seam, a series of details concerning each county, a chem report, an account of the cotten worm by Prof. Grote, and finally conclu with a series of tables giving the altitudes from railroad surveys.

ON THE GEOLOGIC AGE OF THE VERTEBRATE FAUNÆ OF THE EOCEN NEW MEXICO, BY PROF. COPE.—Prof. Cope read an article before the Acad of Natural Sciences, in which he presented a synopsis of the species descr from the Eocene of New Mexico, giving 54 mamalia, 1 Aves, 24 Reptilia a Pisces.

We are indebted to Prof. Cope for a pamphlet entitled, "On a Gig Bird from the Eocene of New Mexico." Prof. Cope exhibited before Academy of Sciences, Philadelphia, a tarsometatarsus of a bird discovere himself; this singular and gigantic bird is discribed in the above pamphlet. named it a Diatryma gigantea.

In the same pamphlet the Professor gives a history of the progress of doctrine of evolution of animal and vegetable types, which is full of intere information.

PROCEEDINGS OF THE BOSTON SOCIETY OF NATURAL HISTORY, VOL. XV PART I, MAY-JUNE, 1875.—This number contains the annual report of the todian, Treasurer, and Secretary, also papers upon the "Habits of the I Crawfish," by Prof. F. W. Putnam; a "Synopsis of the odonate of America, Dr. H. A. Hagen; Geological note by Prof. Wm. B. Rogers; on "The Dec Gneiss of Hoosac Mountain, by T. Sterry Hunt; Prof. Dana on the Alter of Rocks, by the same, and notes on the Noctuidæ, by H. K. Morrison, com ing with a paper entiled "Propositions concerning the motion of contin glacers," by Prof. N. S. Shaler.

JOURNAL OF PROGRESS—A journal "devoted to Popular Science, Progre Agriculture, improved Mechanical industries," etc. Citronelle, Alabama, J. B. Stelle, Publisher. A live, active, paper.

FUGITIVE ESSAYS.—By Col. Charles Whittlesey, Selection No. 3. These consist of articles upon various subjects, by Col. Chas. Whittlesey, Pres't Northern Ohio Historical Society. The number before us contains, papers upon Depression of the Sea during the Glacial period, Ice movements of the same era, Earthquakes of Oct. 1870, Great Mound, Etowa River, Georgia, Rock Inscriptions, The Indian Problem, History of the Coal and Iron business of Ohio, Changes of Level Lake Superior, and many others of equal interest, 18 in all.

WESTMINSTER PAPERS.—A Journal devoted to Chess Drama, &c., W. W. Morgan, London, Eng. We acknowledge the receipt of this interesting journal.

THE ANIMAL WORLD.—Royal Society, Prevention of Cruelty to Animals, London, Eng. We are in receipt regularly of this entertaining and instructive journal. The Animal World is doing a good work and we wish it success, it is finely illustrated.

ON THE GEOLOGY OF PORTIONS OF OUR WESTERN TERRITORY.—We acknowledge the receipt from the Author G. K. Gilbert, of "The Geology of portions of our Western Territory," visited in the years 1871 and 1873. The work contains much valuable information and is illustrated by maps, plates and wood cuts.

THE OHIO VALLEY, VOL. 1, NO. 1.—J. E. Wharton, Editor, Portsmouth, O. Two Dollars a year in advance. This is a new Journal devoted to Archæology. Modern History and Biography. It has 24 pages, is neatly printed, and contains much interesting and valuable information.

A NOTICE OF RECENT RESEARCHES IN SOUND, BY PROF. WILLIAM B. TAYLOR. being a series of the most recent discoveries and investigations in that interesting study.

UNDER THE NORTHERN LIGHTS, BY J. A. MCGAHN.—We acknowledge the receipt of the above very interesting work. It is an account of the voyage of the Pandora, in 1875, in search of a northwest passage to the Pacific Ocean. The work is illustrated by plates and woodcuts, is well written and full of interesting information. The descriptions of Arctic scenery and of Arctic life are vivid and of absorbing interest, and some of the passages are really sublime. London, 1876.

THE CYCLE.—We acknowledge the receipt of this most interesting journal from Mobile, Ala., it is printed on heavy white paper in clear type, and is well edited.

SAGACITY OF ANIMALS.

There is a very general impression that the so called lower class of ani the brute creation, are far beneath the human race in intelligence, feelings capacity to reciprocate and appreciate kindness, or to be hurt and deeply in by slights or harsh treatment from their superiors, the human race. That t not so, but on the contrary, that many of the brute creation deeply feel a l word or an intended slight, and on the other hand fully appreciate an a kindness, the author fully believes, and many facts bear out this belief. In c that the readers of this journal may become more fully aware of the tender fee and in many cases almost human intelligence, the lasting affection for those tend and care for them displayed by the animal world, the editor has made i practice to gather such facts as are well authenticated, which show the intellig or marked examples of tender or lasting affection in animals, hoping by means to implant a better appreciation of their worth, and a more tender loving treatment of the *dumb*, but faithful friends of the human race. In carr out this plan the following anecdote is given this month which exhibits a rem able and almost human intelligence:

A SHEEP FOND OF PRACTICAL JOKES.

The following story is sent by an esteemed correspondent, and the unu incidents related are well authenticated:—The provost of a certain town in S land possessed a pet lamb, which in course of time had developed into a l sheep. In the eyes of his master this animal could do no wrong; but to hi low-townsmen it was a serious nuisance, principally from its persistent repet of the following practial joke. The provost's house was approached by wha Scotland is called "a pend"—that is, an entry with buildings above it—the b ing in this instance being a granary with a window immediately above the en Every day the sheep ascended the stairs to the granary and took his stand at open window. Concealed and silent, he bided his time, until some hapless tor to his master drew near the entry. The doomed man, suspecting no dan leisurely stepped on the threshold, when instantaneously he was felled to the c by the sheep dropping on his shoulders as he passed! Long before he c gather himself up the sheep had run up the granary stairs and resumed his w for another victim. The provost was besieged with complaints against his p more than one fat baillie representing that his life had been endangered by fall and the fright. The provost turned a deaf ear to their complaints, and ei denied the facts, or defended the playful disposition of his favourite; and a was the richest and most important person in the town, his fellow-citizens w compelled to submit, and the sheep enjoyed his joke unmolested. The da retribution, however, was at hand. A county election came on, in which provost played a prominent part; and one day, when he was escorting two gentlemen into his house, bowing and flourishing and making as he thoug fine figure, plump came the sheep on his shoulders and laid him prostrate in mud! What befell the sheep history sayeth not, but from that day forth inhabitants of that town were permitted to call on their provost in safety.—*Ani World.*

THE LEECH TRADE.

One of the trades carried on in the Landes, south of Bordeaux, in France, is that of propagating leeches in the meres near the bay. Formerly the custom was to use miserable, worn out horses, but these poor animals were found by the propagator to wear out too soon—the veins opened by the leeches did not heal, and so the life's blood could not be renewed. Now the cow has to do duty to the young onnelides. Frightened, haggard, but resigned, the animal submits with a stupid kind of astonishment to the attacks of clusters of leeches hanging on legs; and when the moment of utter exhaustion comes she is sent off to her pasture to renew life, and furnish a fresh repast. Two weeks suffice for each process, alternately carried on, until death puts an end to being eaten in detail. The owner of about eight acres of marsh supplies yearly two hundred cows for the nourishment of about eight hundred thousand leeches. He buys the animals for two pounds and sells the carcass for sixteen shillings. The ass is sometimes employed, but it proves to be less resigned than the more patient cow; it kicks and prances, and tries to bite, and when at length it falls into the water under the storm of its numerous enemies, it becomes mad with terror. That this culture of leeches forms an important branch of trade to the inhabitants of the Bay of Arcachon, may be believed when it is known that a million and a half of leeches are annually exported from Bordeaux.—*Sentinel.*

CURIOUS FACTS.

A single female house-fly produces in one season twenty million. Some female spiders produce nearly two thousand eggs About thirty fresh water springs are discovered under the sea, on the south of the Persian Gulf. A wasp's nest usually contains fifteen thousands or sixteen thousand cells. The Atlantic Ocean is estimated at three miles, and the Pacific at four mlles, deep. There are six or seven generations of gnats in the summer, and each lays two hundred and fifty eggs. There are about nine thousand cells in a square foot of honeycomb. A swarm of bees contains from ten thousand to twenty thousand in a natural state, and from thirty thousand to forty thousand in a hive. The bones of birds are hollow, and filled with air instead of marrow. A cow eats one hundred pounds of green food every twenty-four hours, and yields five quarts of milk. Fish are common in the seas of Surinam with four eyes; two of them on horns, which grow on the top of their heads. Two thousand nine hundred silkworms produce one pound of silk; but it would require twenty-seven thousand spiders to produce one pound of web.—*Independent Sentinel.*

A wheat plant exhales, in 175 days, about 100.000 grains of water. An acre of growing wheat, on this calculation, draws and passes out about ten tons of water per day. The sap of a plant is the medium through which the mass of fluid is conveyed It forms a delicate pump, upon which the watery particles run with the rapidity of a swift stream. By the action of the sap various properties may be assimulated to the growing plant. Timber in France is for instance, dyed by various colors being mixed with water and sprinkled over the roots of the tree. Dahilas are also colored by a similar process.—*Sentinel.*

The Scientific Monthly

OPINIONS OF THE PRESS.

THE SCIENTIFIC MONTHLY for March is now out. It presents a large a varied table of contents, ably edited and full of interesting and valuable informati The SCIENTIFIC MONTHLY is a standard authority, and indispensible to t and Scientific World.—*Toledo Blade.*

We should have noticed earlier the reception of a new monthly devoted to of Natural Science, published in our city. under the editorial managem E. H. Fitch, who is also its proprietor. The pages of the magazine with interesting material, furnished by home and foreign contribut of the development of a valuable work in our midst.—*Tol*

A valuable addition to our contemporary scientific literature. Mr. FITCH known as an enthusiastic naturalist and an able writer, and his name will guaranty for the excellence of the new serial, of which the number now before a promising specimen —*Scientific American.*

A bright, sparkling, and instructive periodical.—*Sentinel.*

Ought to be in every home.—*Journal.*

Full of matter at once instructive and entertaining.—*Press.*

The SCIENTIFIC MONTHLY is a model magazine of interesting, instructive knowledge. It embraces the various branches of modern popular scie treats mainly upon the various classes of animated nature, which it deseri a thoroughly practical manner.—*Oologist.*

A Standard Work.—*Star.*

The neat appearance and enterprising air of the SCIENTIFIC MONTHLY, a m devoted to the natural sciences, and published in Toledo, deserves a favora Each number of the work, the prospectus tells us, will contain not l to 80 pages of original and selected matter, contributed by the ablest writers n our country.—*Chicago Tribune.*

We have before us a copy of the SCIENTIFIC MONTHLY, edited and publis E. H. Fitch, of Toledo, Ohio. It is a magazine devoted to Natural Science a discussion of Scientific subjects. The numberbefore us has sixty neatly prin on tinted paper, and its rare subject matter profusely illustrated with acc engraved plates and wood cuts. The articles are from the pens of well-kno and foreign writers on scientific subjects. It promises to be a record of n n the Natural Sciences, which, together with its handsome typograp appearance, renders it equally inviting and entertaining. We pronounce the choice publications of its class of magazine literature, and hope it m live and prosper."—*Coshocton Democrat.*

Highly interesting and instructive.—*Nevada Tribune.*

Both instructive and entertaining, and should be in every household.—*Jack*

The SCIENTIFIC MONTHLY devoted to the natural sciences, published by E. at Toledo, Ohio, is received. It presents a large and varied table of c ably edited, and full of interesting and valuable information. It fills a w want, and all who desire an instructive and reliable publication devoted should subscribe for it. It is richly illustrated. Price $3.00 per annu 'Scientific Monthly," Toledo, O.—*Ashland Press.*

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VOL. 1. No. 10.

JULY, 1870.

THE SCIENTIFIC MONTHLY

A MAGAZINE DEVOTED TO

The Natural Sciences.

LIBRARY OF CONGRESS
JUL 26 1876
SMITHSONIAN DEPOSIT.

E. H. FITCH, Editor and Proprietor.

TOLEDO, OHIO:
TOLEDO COMMERCIAL COMPANY, PRINTERS.

The Scientific Monthly.

VOL. I. NO. 10.

Price, $3.00 a Year; or, 30 Cents a Number.

All communications, of whatever nature, in regard to the Magazine, should be addressed to E. H. FIICH, Editor and Proprietor, TOLEDO, O.

The columns of the SCIENTIFIC MONTHLY will be freely open for all well written articles on scientific subjects, and the candid setting forth of opinions and views on Natural Science.

Any papers sent to the editor will be carefully preserved, and returned to the contributor if desired.

The Secretaries of Scientific Societies are respectfully solicited to forward to the Editor, as soon after the meetings of their respective Associations as convenient, all reports of the proceedings and synopsis of essays and addresses read before them.

This Journal is published for the purpose of exciting an interest in the Natural Sciences, to disseminate knowledge, and as a veheicle or medium for scientists to give to the world the results of their studies and investigations, their views and thoughts upon nature. It is not established for any private purpose whatever, and is *freely* open for the use of all who may see fit to avail themselves of its pages.

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The Scientific Monthly

DEVOTED TO THE NATURAL SCIENCES.

VOL. I. JULY, 1876. NO

THE WOOD THRUSH.

(*Turdus Mustelinus.*)

To one who has a love for the beautiful, no place can have more charms the wild woods. Here, far removed from the turmoils, anxieties and conflic the busy world, he can wander alone and commune with nature. He can lessons of peace and beauty from each budding leaf, each flickering insect. stranger who visits an American forest for the first time is struck by the ri melody that salutes him from the myriads of warbling throats. The Amer birds are not noted for the splendor of their plumage, although we have brilliant exceptions; yet the majority of our feathered inhabitants are pr coloring, and few can compare with them in sweetness of song and varie notes. But it is not alone the birds that attract the enthusiastic lover of natu the woods: a thousand curious insects swarm in the air or inhabit the trees or g gaily painted butterflies float through the openings; graceful dragon flies dar idly after their insect prey; curious walking sticks, and fantastically-shaped wonderfully colored beetles crawl about the bark; an innumerable variety co liantly colored flowers cluster in the sunny glades; while pale and delicate fe peep out from the darker and more secluded nooks. A thousand tints and sh attract his attention as he watches the play of the lights and shades throug leafy canopy over head. The sound of the summer breeze as it sighs through trees, the hum of the teeming insect life around him, the call of the various t of birds, the nimble actions of the forest animals, all arrest and fix his wrapt tion. "To him who has acquired the happy art of enjoying in solitude the ch of nature and of indulging the powers of fancy," each tree, each sylvan note special interest, he learns lessons of wisdom from every plant, every living which he meets.

——"What e'er adorns
The princely dome, the column, and the arch,
The breathing marble, and the sculptur'd gold,
Beyond the proud possessor's narrow claim,
His happy breast enjoys. To him the Spring
Distils her dews,. and from the silken gem
Its lucid leaves unfolds; for him the hand
Of autumn tinges every fertile branch
With blooming gold, and blushes like the morn,
Each passing hour sheds tribute from her wings;
And still new beauties meet his lonely walk,
And loves unfelt attract him. Not a breeze
Flies o'er the meadow; not a cloud imbibes
The setting sun's effulgence; not a strain
From all the tenants of the warbling shade
Ascends, but whence his bosom can partake
Fresh pleasure only: For the attentive mind
By this harmonious action on his powers
Becomes herself harmonious." *

Thus can the true student or lover of nature draw pleasure from every object which surrounds him, and his greatest happiness is to retire to

——"Some calm sequestered spot;
The world forgetting, by the world forgot." *

And in peace and quiet meditate upon the wonders and beauties which are strewn about him. Among all the numerous forest warblers which delight the ear by their charming notes, there are none that can surpass the wood thrush in sweetness, melody and clearness of song. Early in the Spring the woods and groves ring with its clear mellow notes, and announce his welcome arrival.

The song of this beautiful bird consists of a few clear, ringing and melodious notes, some of which resemble the sweetest notes of the flute, others the clear tinkling of a small bell; the whole song consisting of five or six parts, and is clear and mellow, rising and falling in gentle cadences, the effect of which is particularly sweet and soothing upon the mind.

This charming and lovely songster delights in low thickly shaded hollows, through which a stream of water meanders, overhung with alder bushes and entwined with grape vines. He is a sweet and solitary songster, and loves the thick dark woods, where the bushes grow close and the foliage is dense; here, secluded from intrusion, he builds his sylvan home; and here where the mellow beams of the moon silver each rippling wavelet of the forest brook and the sunshine dots the mossy banks in golden spots, he delights to warble his charming lay.

The Wood Thrush arrives from the south in Ohio about the 21st of April, and returns south early in October; as soon as he arrives he announces his presence by his charming song, which rings through the woods and groves in clear and musical notes; he is one of the chief musicians in the morning concert of our birds. During the heat of the day he remains comparatively quiet, but when evening approaches and the sun begins to tinge the western sky with a mantle of purple, crimson and

*Zimmerman's Solitude.

gold, he again breaks forth in a grand and glorious anthem, one that ascen praise to the creator and benefactor.

Those who ramble through our woods or ride out in the country durin months of May or June can not fail to be charmed by the ringing bell-like w of this forest musician. Even in dark, wet and gloomy weather, when each and leaf is dripping with moisture, the clear notes of the Wood Thrush through the dismal, dripping woods, from morn till eve, and, as Wilson sa may be truly said that "the sadder the day the sweeter is his song."

The Wood Thrush is a solitary, shy, and retired bird, appearing only s or in pairs, he delights in keeping in the shadiest, gloomiest parts of the fo where the sun is completely shut out or only a few flickering beams struggle thr the waving canopy of green above, and spangles the glistening surface o water of some sylvan rill, with spots of gold and yellow light. Here, fixe some horizontal branch of a small tree six or eight feet from the ground, is p its nest, which is composed outwardly of dry leaves, closely united together a ently while wet, but becoming dry and as firm as parchment; these are mixe strengthened with dry twigs, and the whole is lined with fine roots and dry gr The nest is five inches in diameter, three and three-fourth of an inch in deptl cavity inside being two and one-fourth inches deep, and three inches in diame the top.

The eggs are four, sometimes five, deep blue slightly tinged with yellow, g them a greenish tinge, and are one inch long by three-quarters inch wide. brood is raised in a season. The period of incubation is fourteen days.

The Wood Thrush inhabits all of the United States east of the plains o Missouri, excepting perhaps Vermont, New Hampshire and Maine; it b throughout this wide range, and winters in Central America. In the Ber islands, Cuba and Honduras it is quite common. Although so fond of retreats the Wood Thrush sometimes frequents and even breeds in the vicin human habitations, building in the orchard or near the farm house. The bord our forests are also its favorite retreats, and here they may be frequently seen per on the topmost branch of some tall tree, where they pour forth their sweet me

The food of this species consists of berries, small fruits and insects. flight is firm, easy, and elevated. They sing well in captivity and the youn easily raised, the flesh is delicate and juicy.

The Wood Thrush is eight inches long, and thirteen in extent of wings. upper parts are a clear cinnamon brown, becoming more rufous on the top o head, and on the rump upper tail coverts and tail olivaceous. Wings like the l The under parts are pure white, tinged with a clear buff on the breast, th marked with heart shaped and sharply defined spots of deep black, except the throat, vent and lower tail coverts, which are plain white; sides of head and dark brown, streaked with white; a series of black and white spots run fron corner of the mouth down upon the side of the throat; bill brown above, color below; legs and feet pale, almost transparent flesh color, or pale pi

white; around the eye is a narrow ring of white; pupil black; iris dark color; inside of mouth yellow. The sexes are alike in size and coloration.

DETAILED MEASUREMENTS.

Upon the first view, the body of this specie appears short and thick, the long and slender, yet the whole contour is graceful and elegant in the extreme.

The following are the measurements carefully made from a very perfect specimen:

Tip of upper mandible to forehead five-eighths inch.

Tip of upper mandible to end of longest tail feather eight inches.

Tip of upper mandible to outer corner of eye one inch long.

Tip of upper mandible to outer corner of nostrils half an inch.

Tip of upper mandible to corner of mouth one inch.

Tip of upper mandible to end claw on middle toe, eight inches, inch.

Tip of lower mandible to chin feather three-eighths inch.

Tip of upper mandible to hind head one inch, sixth-eighths inches.

Carpal joint end longest primary, four inches, two-eighths inch.

Carpal joint end secondaries, three inches, one-eighths inch.

Tarsus, one inch, two-eighths inch long.

Tail, middle feather, three inches, one-eighth inch.

Tail, outer feather, same.

Tail, beyond longest primary, one inch, two-eighths inch.

Tail, beyond secondaries two inches.

Tail, beyond claw on middle toe, the tail extends just to the end of when legs are stretched back, then the whole foot is beyond end of tail.

One plate on tarsus on each side joining frontal plate and each other sharp edge, only one plate on the front of tarsus from knee to base toes. one and three-eighths inch long.

Bill gently decurved at the tip, and notched, rictus with small bristles, narrow at base, commissue not more than twice the distance from the nostrils of bill, twice as long as the gonys.

Diameter eye, two-eight one-half eighth inch.

Diameter nostrils, half eighth inch.

Weight, two ounces Av.

Height of upper mandible at base, one-eighth inch.

Height of lower mandible at base, half-eighth inch.

Width bill at base, two-eighths inch.

Outside toe longest, its claw just reaching base claw on middle toe. twice as long as the bill on top.

13 plates on top middle toe; 10 on inside toe; 12 outside and 7 on hind

Bill on top equal to middle toe.

Frontal feathers advance on each side to inner corner nostrils, and parted front at an acute angle one-sixteenth inch deep; chin feathers advance to

outer corner nostrils; feathers on side lower mandible rounded in outline, and one-eighth inch back of inner corner of nostrils.

Tarsus longer than middle toe.

WING FORMULA.

Outer.	*Second.*	*Third.*	*Fourth.*	*Secondaries*
Spurious, two and two-eighths inches shorter than longest.	One-eighth inch shorter than longest.	Longest.	Half-eighth inch shorter.	One inch shorter than longest.

Secondaries and tertials all equal length, wide truncated at ends.

Middle toe six-eighths inch, its claw three-eighths inch.
Outside toe four-eighths inch, its claw two-eighths inch.
Inside toe three-eighths inch, its claw two-eighths inch.
Hind toe three-eighths inch, its claw four-eighths inch.
} On curved top

Tail beyond upper coverus one inch.

Tail beyond lower coverus sixth-eighths inch.

OCEAN DEPTHS.

How wonderful is the world wide ocean, with its ever changing aspect illimitable boundless expanse, now glittering and sparkling in the sunshine, its placid, gently heaving bosom were studded with many bright gems, or reflecting the rainbow tints of a brilliant sunset in its transparent rippling surface depicting as in a mirror the fleecy clouds as they pass over head, or the starry hosts of heaven above. Then again lashed to fury by the storm king, angry foam crested billows dashing in thunder tones on the shore.

What strength and energy its bracing and invigorating salt laden atmosphere gives to the enfeebled system; what music there is in the eternal roar of its billows upon the beach. The ocean is indeed a never ending subject of interest, of such fascination that few who once see it can forget its charms.

Scientific research has developed the fact that the average depth of the ocean is about five miles, and that the greatest storms and mightiest tornadoes affect only the surface of the water, that while the face of the deep is lashed into fury and is tossed by seething roaring billows, the bottom lies tranquil and unmoved. The thundering waves and tossing billows, repose upon a cushion of still quiet water, and everywhere at the bottom of the sea, the earth is protected with a garment from the abrading action of its waves and currents. Here down at the bottom of the grand old ocean, beneath the mighty mass of water the minutest shell lies, safe and unharmed, for the bottom of the ocean presents silent, motionless, dark world, no sound, no light, can here penetrate the enveloping mass of water above.

When we witness a mighty storm upon the ocean, when the foam crested waves roll "mountains" high, and break with deafening roar, and teriffic and gigantic force against the rock bound coast, making the solid earth tremble with their mighty shock, it is difficult to conceive that down in the depths of the ocean reigns an undisturbed calm, an unruffled quiet and repose, where no sound of the roar of the teriffic contest raging above is heard, no shock of the mighty warfare, the battle of the elements over head, is perceptible. Yet so efficient a protector is the thick cushion of water, that the effects of the greatest tempest extends but a short distance below the surface.

The ocean is constantly dropping the minute mineral and animal substances, held in suspension, upon its bottom, there is a continuous shower of little shells upon its bed, and in process of time they form a deposit of the most delicate white, like a covering of snow upon the ground, which spreads over the bottom of the sea as with a delicate frost work, and one can readily conceive that wrecks that strew the ocean bed are in process of ages hidden under the fleecy covering, presenting the rounded appearance which is seen over the body of a traveler who has perished in the snow storm, thus enveloping all the dead who sleep upon the ocean's bed with a shroud of the purest white and most delicate construction.

The ocean, especially within and near the tropics, swarms with life. The remains of its teeming inhabitants, of the myriads of moving things who dwell within its waters, are conveyed by currents and scattered and lodged in the course of time, all over the bottom. This process continued for ages, has covered the depths of the ocean as with a mantle, consisting of organisms as delicate as hoarfrost, and as light in the water as down in the air.

A NATURAL CURIOSITY.

In Upson County, Georgia, is a curious spring; it is about twelve miles from Thomaston, and is called the Thundering Springs, from the rumbling noise of the bubbling water; it is located in the wildest part of the mountains, in the northern portion of the county. The spring is about five feet in diameter and of an unknown depth, for repeated soundings have failed to reach the bottom; the water boils up with great force, bubbles of gas constantly rising up through the water, and explode upon the surface; this gas is highly inflammable, and is frequently set on fire as it makes its escape. Such is the force with which the water arises, that a human body is buoyed up and cannot sink, but is sustained and upheld in a standing position. It is a famous bathing place. The earth around the spring is a beautiful white sand of very fine grain, giving away readily at the touch of the foot, but immediately reforming on its removal, so that no impression is retained. The walls of this spring are formed of the same white sand, they are perfectly symmetrical and have the same facility of giving away to bodies and immediately reforming upon their removal. The temperature is delightful and the waters are said to be very beneficial for skin diseases, and are much visited.

SPRINGS.

T. A. FELCH, M. D.

The contemplation of the varied phenomena of nature has for all an absor and enticing interest. This interest is fostered and encouraged by that curi inherent in human nature, which impels us to seek for the hidden cause of obse effects, and use every endeavor to free the phenomenon from the halo of mys and doubt by which it is surrounded. Considering animal life alone, we see completely dependent it is for all its comforts, and even life itself, upon the oc rence of processes entirely external to itself.

The element water, in many respects so intimately connected with our being, deserves more than a passing thought. It is not in regard to its dom use simply that we desire to speak of this fluid, but rather to examine into mechanical conditions to which it is subject, and to seek an explanation of cer of the phenomena therein presented to our view.

A spring is a current of water flowing out of the ground, and is produce the water falling upon the earth and percolating through the soil by mean crevices, cracks or porous strata, until it reaches some impervious rock wher further progress is arrested, and it forms underground reservoirs and then s some passage upward and outward through porous or pervious strata to the surf where it issues in the form of springs, or fountain heads to our rivers, creeks and brooks. Rain, snow, dew or hail falling upon the earth are the sources f which springs derive their supply, and these latter owe their origin to the evap tion constantly taking place from the surface of all bodies of water exposed to atmosphere.

It is capable of mathematical demonstration that the quantity of water charged into the sea by all rivers does not equal the amount abstracted by eva ation. Of the quantity of water descending from the clouds upon the earth, assists in keeping up atmospheric moisture, another part seeks its destinatior the brooks and rivers, while still another portion permeates the soil and in ol ence to certain natural causes, of which we will speak hereafter, emerges a and appears upon the surface.

Springs have always been a subjects of great interest and are suggestiv fertility, greenness, and cool and refreshing purity; in their flow they exhibit quality of the soil or rock through which they pass. Those of the same vici supplied through different strata, and from different sources, are materially di ent in their qualities, some forced up through beds or layers of clean sand, ar tered of all impurities, although their source may be in dense swamps filled decaying vegetable matters, others flowing through limestone, although clear apparently pure, are so charged with calcareous matter that the water is ter "hard," and still others issuing through sandstone rock are eminently pure clear, thus the *quality* of spring water depends in a great degree upon the st through which the water flows.

A singular quality of some springs is their rising a short time before rain. A spring on the top of a high hill in Rutland, Vermont is thus affected, sometimes as long as two days before a rain fall, this phenomena has been accounted for by supposing that it is due to a diminished atmospheric pressure, for the height of of a spring at any time is determined by the relative force exerted by the atmosphere to keep the water down, and by the hydrostatic pressure to lift it up.

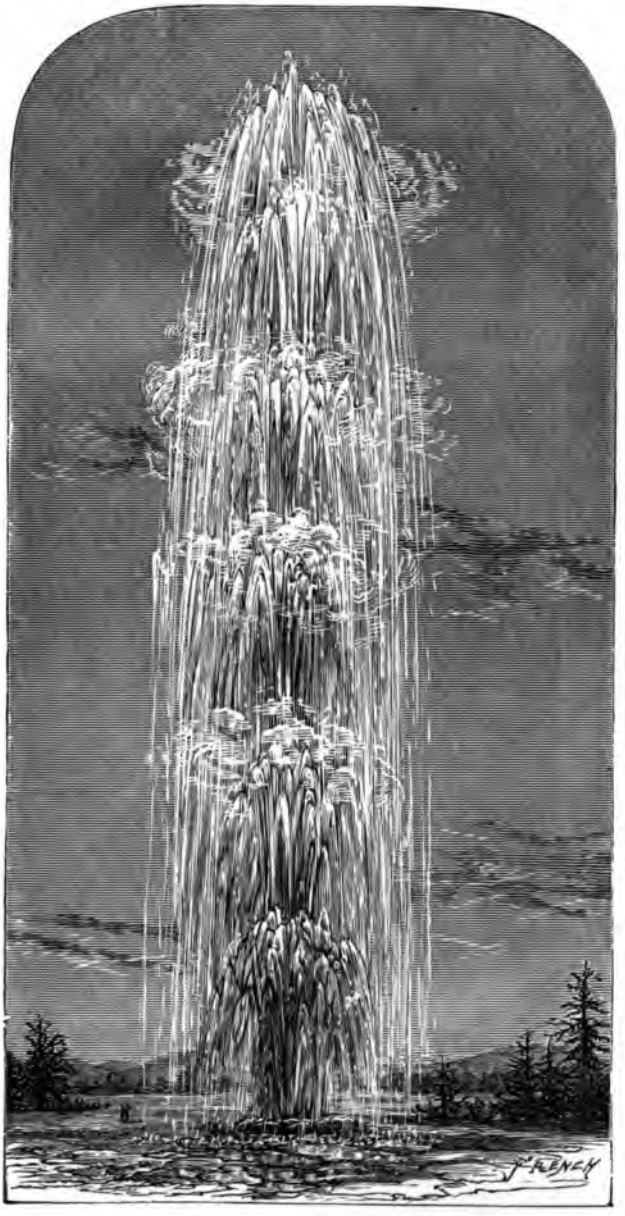
All springs and wells are more or less impregnated with mineral elements, derived from the soil through which the water passes, while some from the excessive quantities possessed or the peculiar qualities of the mineral substance have become noted for their curative properties. Springs flowing from great depths and thus coming within the influence of the internal heat of the earth, or which have their source from reservoirs which are in contact with heated lava beds, or are reached by steam from heated subterranous or volcanic regions, are warm or even boiling hot, and are called thermal or hot springs.

In the study of the phenomenon of springs and wells, it is necessary to mention a few facts with which the science of Geology acquaints us. The superficial crust of our earth is composed of distinct layers or strata of earthy materials, differing from each other in density and chemical constituents. It is not our intention to enter into a history of that subject, but suffice it to say, that these strata are arranged in regular and progressive order, and wherever found presents the same general characteristics. To be sure their line of continuity has in many places been broken by the mighty forces of the earthquake, the grinding power of the glacier or the erosive action of water; but these very circumstances serve to explain phenomena which would otherwise remain unsolved. The strata in most places present an inclined plane, and consequently the fluid reaching the layer would by following the law of gravitation course along its inclined surface. By a beneficent arrangement of Providence the various strata differ in their degree of density, and consequently in their perviousness to water. It is interesting to note the immense quantity of water which rocks are capable of retaining in their substance.

"Some granites in their ordinary state contain a pint and a half in every cubic foot." "In the best building stones belonging to the sandstone group, from four to five pints of water are contained in each cubic foot of the stone." "The quantity of water capable of being held by common loose sea sand amounts to at least two gallons in a cubic foot."—[*Ansted.*

"Chalk is highly absorbent, many of its strata being able to take up half their bulk of water without even appearing to be moist." "Ordinary sandstones hold nearly a gallon in a cubic foot."—[*Child.*

In excavating the Mt. Cenis tunnel the dense granite rock dulled the best drills used, still, from the cut surface, oozed such a quantity of water as to render a conduit necessary. With the above facts for data, how inconceivably great must be the quantity of water stored within these reservoirs, how inexhaustible the supply! Here, then, is the source, the fountain head, of all our springs and wells. The constant tendency of water is to seek its level, and not even the rocky barriers are able to confine it; thus we find it issuing from the sides of hills, in valleys, on plains and even under the bed of the ocean itself.

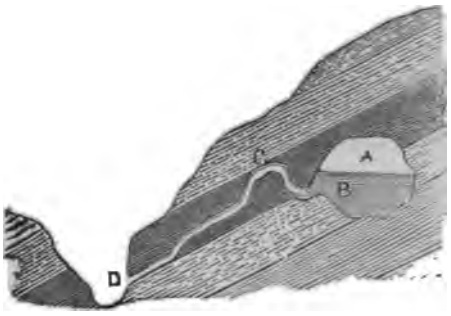


THE GIANTESS.

A Geyser in the Yellowstone Park, Wyoming Territory, U. S. A.

Springs of water issuing from the sides or base of hills are usually direc
plied by the rain and snow which falls upon the hills, and consequentl
subject to great variations in regard to the amount of water discharged.
zerland many springs flow freely during the warm months as they th
their supply from the melting snow and ice. At other times they are al
erated.

"Intermittent springs form an interesting feature in connection w
subject. Some of these springs flow at regular intervals, once or twice
a period of two or three months, or, it may be, once or twice a day, or
hour. The cause of the first is due to the irregularity of the fall of rain,
of snow and ice, which supplies them. Many glacier-springs flow only in
while others emit waters only during the middle of the day, while the h
sun is sufficient to melt the ice from which they are supplied. The Engstl
in the Haslithal, Canton of Berne, Switzerland, is of this kind. It flow
middle of May to the middle of August, and, during this time, only
o'clock P. M. to eight o'clock A. M., but if the season is cold, it does not
all."—[*Walton.*



Many springs discharge water upon the principal of the siphon,
illustrated in the annexed diagram. The reservoir A is fed by the rain
ating through the strata. B C D is the siphon-shaped tube leading to the
When sufficient water is in the reservoir to charge the siphon, water will
until the fluid in A is drained off below the level of the arch C, when it
only to flow again when A becomes filled to the level of the arch.

Wells which are situated not far from the sea shore sometimes show
of the ebb and flow of the tide; as at Richmond, where "the rise at high
seen in the wells which flow from the arenaceous strata on the banks of the
When the reservoir or water bearing strata is situated deep beneath the
contents sometimes finds their way upwards by means of "faults" in
the Well of St. Winifred, at Holywell, in Flintshire, and our own Saratoga
are good examples of this system of supply.

"But, the most remarkable intermittent springs are those which are
of the tension of hot vapor. The most wonderful of these are the Geysers

land, and those of Wyoming Territory. The outlet of these springs is the mouth of a silicious tube, reaching down some forty to sixty feet in the earth. This tube being full of water, the pressure exercised on the water at the bottom of the tube raises its boiling point: that is, while water boils in the open air at 212° F., the degree to which it must be elevated under a pressure equal to that at the bottom of a tube sixty feet long is 251° F. When a layer of water at the bottom of the tube is elevated to this temperature, it evolves steam; but, as soon as the bubbles pass to the cooler layers above, they are condensed. When the succeeding layer above is heated to the boiling point, the escaping steam-bubbles are condensed in turn in the superincumbent layers. After a time however the entire column of water to the surface reaches the boiling point, when much of the water throughout the entire tube suddenly becomes steam and an explosion immediately occurs. This is the explanation given by Prof. Bunsen, and that it is the correct one, has been demonstrated by Prof. Tyndall, who constructed an iron tube, with a bowl surrounding the upper opening and an iron bulb at the lower end, in which all the conditions named were fulfilled, and on heating the water in the bulb he obtained the result indicated—a miniature geyser, jetted steam and water into the air, displaying all the phenomena of the geysers in a miniature form."—[*Walton.*

The depth at which water may be obtained from the soil varies from a few inches to an unknown distance. In climates or places which are habitually moist, a supply may be gathered by simply digging a hole on the surface of the ground, at the depth of a few feet only. This becomes a reservoir for the small amount drained from the surface soil, and though often not of that degree of purity to make it most desirable for domestic purposes, still it serves a useful end, and, when better cannot be procured, a much prized supply. Even on the Coral Islands of the Pacific Ocean, and when in the progress of their formation, their crests rise but little above the surrounding waters, fresh water may be obtained, though the salt ocean entirely surrounds them, and the enclosed lagoon is also salt.

Mariners are well acquainted with this fact and often stop at such islands to fill their tanks. It has been generally supposed that this fresh water was merely the sea water freshened by filtration through the earth or rocks, but Darwin concludes that it is rather the surface drainage of the islands. It is evident that as the surface of the earth is so immediately exposed to both sun and atmosphere that evaporation will be exceeding rapid and therefore the supply derived from the superficial strata will vary with the existing climatic conditions, there being an abundance in wet and a scarcity, or absolutely none at all in dry weather.

Gilbert in his Report on the Geology of the Western Territories says: "The sandy margins of some rivers and lakes in the arid regions—bars and beaches accumulated by the adjacent water—are far more saline than the water. The water of the Colorado river, for example, carries so little salt that it is perfectly palatable. But while camping in the Black Canon, and in the lower part of the Grand Canon, it was our custom, in order to avoid the fine mud with which the running water was charged, to dig shallow wells in the sand close to the water's edge, and the water obtained from these wells—which was merely the river water

filtered through the sand—we found always saline, often in such a degree prevent its use, I conceive that the sand kept moist below by the percolation the river and rapidly dried from above, had stored up the saline constituents water, which evaporated within its body so as to produce the result we obse * * * I am persuaded that there is within the porous earth of the sh slow circulation *shoreward*, by reason of which the salt of the lake is conv into the sand, just as the salt of the river is conveyed into the lake."

As we have upon the surface of our globe running streams and large c tions of quiet waters, so there are facts to prove that the same conditions beneath the surface. The Mammoth Cave of Kentucky possesses its river cascades and its lakes. Whence they arise or whither they go is beyond knowledge.

"No one who has visited the caves at Adelsberg can have forgotten how Poik, then larger and swifter than the Mole where it joins the Thames, plu amid the gloom into the tunneled mountain and is lost. Its course no one kn but bits of wood and other pilot substances borne along its mysterious wa ings proclaim its identity with the Unz, which emerges as a full formed riv Planina, ten miles beyond on the other side of the mountain."—[*Child.*

In the Jura Mountains of Switzerland fully formed rivers spring from side of the mountain with sufficient force and volume to turn the wheel of a mill.

Subterranean streams always flow over limestone strata and not on p sandstone, as the former is more fissured and its substance easily dissolved and rubbed away by the action of the water. Many caverns are formed b above process.

"To this tendency of the limestone strata to fissure and separate into l which form underground passages we owe what are termed 'swallows' in stre Of these we have an example near London in the Mole, which partially 'l her diving flood' in traversing the picturesque vale of Mickleham."—[*Child.*

Many interesting examples of subterranean streams and lakes exist in N America particularly in our western territory, where numerous rivers after fl for a distance upon the surface sink and disappear underground, some never to pear, others to arise, after many miles of subterraneous flow, and continue course as surface streams.

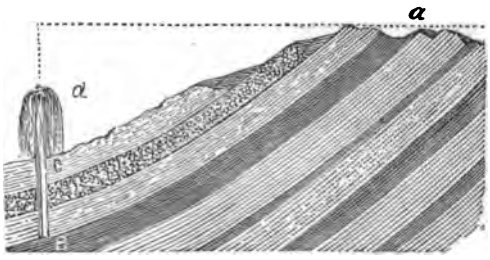
Many underground lakes also exist and in other places large streams of volume arise from their subterraneous course and flow on the surface. In Nicojack cave, Dade Co., Georgia, is a waterfall three miles underground.

As these underground streams leave the caverns through which they they occasionally fall into other chasms and disappear, and are sometime lo ever, or come out again in great springs, it may be miles away, sometimes it pens that the readiest outlet is in the bed of the ocean, and clear fresh wa forced up by its great head or pressure, through the salt water, so that it ma collected at the surface almost entirely pure and unmixed. There is a spri this kind in Boston Harbor under long wharf which supplies ships with

water, another off the south coast of Cuba several miles from shore rises with so powerful a jet that boats cannot approach near the spot.

Artesian wells act upon the principal of the siphon, the water-bearing strata being the longer and the boring the shorter arm.

This is illustrated by the annexed diagram from Dana's Manual of Geology. Let *a. b.* represent an impervious layer of clay above which are the pervious water-bearing strata; *b. c.* the boring, and *d.* the jet of water. The height of the column of water is not as high as the source of supply, simply on account of the friction along the bed of the stream and to the atmospheric pressure. In exceptional instances the force of the projected waters may be due to the pressure upon the subterraneous water of gases confined over them.



Vast regions of our fair earth are, from dearth of water, rendered barren and uninhabitable; capable of sustaining neither animal or vegetable life. Seemingly all that is needed is a constant and abundant supply of this essential fluid, when, as if touched by the magician's wand, the sterile desert would indeed "blossom as the rose." Such is the theory, and experience proves its truthfulness. The efforts of the French in portions of desert Africa show that deep underneath that arid waste lie these reservoirs of water, only awaiting the intervention of art to give exit to their contents and to spread themselves out upon the burning sands. The effect is seen almost immediately. The atmosphere becomes moist and cool, vegetation soon begins to spring up, and, as time progresses, trees appear; birds and the smaller animals seek a residence there, and the entire nature of the place is changed. Such results are in themselves wonderful and their effects, and in a commercial point of view, cannot be over estimated.

There are very few regions which possess such unfortunate geological features that the above facts cannot be realized therein.

What is known as the American Desert can, in most places, be irrigated and made fertile by streams from Artesian wells.

These wells are often of great depth. That at Grenelle, Paris, is 2,000 feet deep and at first rose to a hight above the ground of 112 feet, and discharged nearly one million of gallons a day. Another at Westphalia, Germany, is 2385 feet deep, and one at St. Louis, Mo., 2,200. A singular feature in connection with this subject is that in alluvial regions, borings are often successful when the

high lands, from which the stream must necessarily obtain its supply, its "h is situated long distances away, in many instances more that a hundred miles the point where the strata is tapped.

A second outlet to the same water-bearing strata by removing the l pressure materially interferes with the flow of the first. As the water ob from these wells has reached the site in which it is found only by perc through the superimposed strata, it has necessarily undergone a very tho system of filtration, and as regards certain deleterious properties, it is remi pure. But owing to the solvent power of water, it must, in its contact wi much inorganic matter, absorb large quantities of such ingredients, and ther frequently is unfit for potable purposes. The purest drinking water is pro from springs issuing from the base of hills and mountains, as they receive supply directly by percolation through the soil of the rain and melted snow has fallen on their summits. Wells of moderate depths come next in pu purity, while the artesian wells often contain enough foreign material to them to be considered as "mineral." Springs issuing from granite and insoluble rocks or from the foot of glaciers are remarkably free from fo ingredients, and the more dense and impervious the substance (insoluble to over or from which the stream flows, the purer the water. Springs flowing a soft rock or issuing from a porous or marshy soil filled with organic materials as a class, very impure and unfit for drinking purposes. After the first 1 the deeper the sourse of the supply is situated beneath the surface of the ea higher is the temperature of the water, increasing at the rate of 1° for every feet of descent.

(*To be Continued.*)

THE CULTIVATION OF FLOWERS.

God has implanted in nearly every one a love for flowers; our instinct us to delight in having them around us; their beauty, their perfume and their and almost endless variety, have irresistible attractions for every one. Wh are thus contributing to our æsthetic tastes and cultivating the finer and l qualities of our natures by surrounding ourselves with flowers, we are at the time conducing to our health; for we are thus led to surround ourselves objects at once beautiful and healthy. Science has proven that these adorn of the house and garden, the beautifiers of the forests and fields, are end with health giving and preserving qualities. Plants, as a rule, absorb and from the atmosphere that noxious gas, carbonic acid, which if left to overlo atmosphere, would soon destroy animal life. Plants, also, at the same exhale oxygen, a life giving gas, which is so much needed by the animal cr Plants also act as powerful disinfectants—they tend to purify the atmos The disciples of Empedocles were wont to grow aromatic and balsamic around their dwellings in the belief that they were thus guarding them

against fevers, agues, &c. "Oxygen, when highly electrified, and so rendered especially vitalizing, has in recent times been distinguished by the name of ozone; this is one of the chief elements of a healthy atmosphere." "It is ascertained that the quality of osone is materially increased by the exposure to the rays of the sun of various plants."

Thus then "while the manufacture of ozone is an independent work carried on by the flowers alone, the green leaves," the lungs of the plant, "are performing their sanitary function by extracting carbonic acid gas from the atmosphere," and exhaling oxygen, helping to preserve that proportion of the elements of the atmosphere most conducive to health.

"The cultivation of flowers is a work not merely delightful and humanizing in itself, but one, which, in a way most beautiful and picturesque, confers a positive benefit on society; so great that it can hardly be over estimated, especially in cities and large towns, where there must necessarily be so much to poison and deteriorate the air we breathe." In the sick room too, by their beauty, cheerful aspect, sweet perfume, and health giving and purifying properties, they are great and inestimable benefits, and should be treasured and cultivated in every household; a few thrifty plants in a window, a tasty, well arranged and carefully kept hanging basket, filled with graceful vines and delicate flowers, hung in the window or on the verandah, greatly adds to the cheerful and inviting appearance of a homestead.

Then the delightful occupation and the knowledge one gets from their care, well repays the little time and expense they entail. The humblest cottage, the meanest hovel, may be rendered cheerful, nay even inviting, if adorned with a few thrifty and tastefully arranged flowers and plants, a vine entwined around a window or over a door, a few pots filled with blooming plants on the window sill, will attract the admiring gaze of the wayfarer.

In all ages and in every nation the love for flowers has been a sign of a cultured and refined taste. It is a true and faithful adage that he who loves and cultivates flowers and shows an aborbing taste for nature, a desire to surround himself with the things of the natural world, must be possessed with a tender heart, a refined and sensitive nature. Communion with nature can but tend to increase this feeling and foster those tender sympathies and tastes.

And, seeming as if she wished to aid us in refining, and drawing us closer to herself, nature has been bountiful in strewing at our feet with a lavish hand, these beautiful symbols of a creator's love and affection for mankind; she has scattered them over hill and dale, she has clothed the valley and the hillside, the mossy banks of the sylvan stream, the rocky margin of the mountain torrent, even the alpine heights and the ocean depths, are beautified by the presence of these sweet consolers of human woe.

From the modest little violet which peeps from beneath its canopy of green, to the gorgeous peony which attracts by its scarlet splendor, the world is full of these adornments of nature.

Flowers have always been tokens of love and offerings of peace and affe With flowers we are accustomed to decorate the graves of our departed fri and the bride would seem unadored without these sweet adjuncts. The conqu path is strewn with flowers, and the poet has his wreath interwoven and his entwined with these symbols of love and beauty.

ARCHITECTURE OF ICE.

Wonderfully and exquisitely beautiful is the construction of the clear c ice that covers our lakes and ponds. If we closely examine water as it s freezes, we will observe that the ice in forming is composed or built up of de six rayed stars. A six rayed star is typical of the construction of all ice built up of such forms beautifully and wonderfully interlaced.

If we take a slab of ice and place it in the path of a concentrated sunl we will observe that part of the beam is stopped in its track through the ice part passes through, the former produces internal liquefaction, the latter pa has no effect upon the ice. But the liquefaction is not uniformly diffused thr out the ice. From seperate spots of the ice little shining points are seen to sp forth, every one of these brilliant little points is surrounded by a beautiful flower of six petals, which has taken the place of the ice stars, before notice

The central point is a vacuum, ice being lighter than water bulk for bu swims and when melted it shrinks in size, therefore the liquid flowers c occupy the whole space of the ice melted. A small empty space is formed the flowers, and this space shines in the sunlight like burnished silver, and bright spot we noticed.

In all cases these flowers are formed parrallel to the surface in freezing, are often so small as to need a magnifying glass to detect them; thus is th powerful, yet soft and delicate sumbeam able to take the ice molecules without deranging the order and plan of their architecture.

In this exquisite way, formed of delicate and shining stars, all placed pa to the surface, is every bit of ice formed, seeming as if the image of the hosts in the heavens above, which the smiling and placid surface of the parent waters had so often reflected in its bosom, had been congealed and preserved in this beautiful form in the ice, and then, as if still reluctant to their exquisite images, when the rays of the sun melts and looses them from icy fetters, the melting ice is at first loosend in watery stars or six rayed flo images alike of the pale primroses that line the borders of the lake and k tranquil waters as they bend over and view their own sweet faces in the c below. Thus are the pictures of the stars reflected in the pellucid w preserved in icy fetters, and slowly lost as these fetters are dissolved.

It may, perhaps, be asked how it is that the particles of water, which liquid state seem so utterly without form, can in freezing arrange themselv

such delicate and beautiful shapes and figures. All matter is supposed to consist of minute particles called molecules, and these ultimate particles of matter, inconceivably small as they are, possess attractive and repellent poles, by the mutual action of which the shape and structure of the crystals are determined. In the solid condition the attracting poles are firmly and rigidly held and locked together but if sufficient heat is applied to them, the bond of union is dissolved, and in the state of fusion the poles are pushed so far asunder as to be practically out of each others range. The natural tendency of the molecules to build themselves together is thus neutralized. But when sufficiently cooled the molecules are brought within the reach of each others attractive forces, and the play of the crystalizing force, and arrange themselves in forms of indescrible beauty. When snow is formed in calm air the icy particles build themselves into beautiful stellar shapes, each star as in the ice, having six rays.

In ice, the stars are formed of slender six sided prisms terminated by six sided pyramids. These prisms arrange themselves in lines crossing each other at angles of 60° to 120°, thus forming those beautiful and exquisite ice figures, which we have above described. In freezing the molecules have a tendency to attach themselves to foreign substances in the water, thus ice is seen first to form around stakes or on the edges of the banks. Sometimes when the whole water to the bottom is chilled below the freezing point, but under conditions of quietness opposed to the formation of ice, ice forms at the bottom around some foreign substance which act as points of congelation, and then by reason of its lightness when loosened from the bodies which hold it, it arises to the surface. As water in freezing expands and becomes when ice ligther, therefore ice is always found upon the surface except in the exceptional instances above given. In clear cold nights when the surface of the water is not frozen, and its temperature is at the freezing point, and that of the air still lower, ice is observed to form around substances at the bottom as above stated. Although in freezing water expands, yet when the cold increases, ice is found to contract, and in extremely cold weather its particles in shrinking part assunder with loud reports, as is often heard upon the surface of ponds in very cold nights. The force which water exerts as it expands in freezing is prodigious, and enough to rend assunder the strongest rocks, and break the tightest bonds this is taken advantage of in splitting assunder trees and stumps, water being poured into crevices which being sealed up are rent assunder in the expansion of freezing. It does indeed seem wonderful that a substance so powerful can be constructed of such delicate and exquisitely beautiful forms. The architecture of ice may be partially exemplified by the formation of the frost upon our window panes, here the slender six sided prisms may be observed to shoot out and arrange themselves into the delicate stellar forms, but the inequalities of the glass, the presence of foreign substances and various other circumstances modify the formation so that their regularity is often broken and the arrangement of the crystals disturbed. But here the figures are wonderfully beautiful and delicate. How strange, how delicate and wonderful is the work that is being performed in the natural world, in the air and in the waters around us!

WATER SPOUTS AND WHIRLWINDS.

Among the many wonderful and remarkable phenomena exhibited by na perhaps none excite more interest than that of water spouts and whirlwinds. owe their origin to the same cause—the meeting of two opposing currents of

A water spout presents the appearance of a funnel or cone shaped colun water, resembling in form a conical cloud, the base of which is presented upw and the vertex of which generally rests upon the ground, or surface of the w but sometimes assuming the contrary position. They apparently cousist of d masses of aqueous vapor, presenting a gyratory and progressive motion. Vi and disasterous effects often accompany these meteors. Large trees are torn by the roots, stripped of their leaves, and exhibiting all the appearance of ha been struck by lightning, are projected to great distances. Houses are thr down or unroofed, fences destroyed, when they lie in the course of a water sp Rain, hail, and frequently globes of fire accompany these meteors, while advance is attended with a sound like that of a wagon rolling upon a rough p ment.

Before a fuller account of the cause of this phenomena is given, a few atives of their occurence in different portions of the world will be given Lardiner's Lectures.

On the 2d of Nov. 1729, about 8 o'clock in the morning, at Montpelli small and very obscure cloud was seen in a very elevated position, in the direc of the Southeast whence the wind then blew. It advanced toward the town a noise, at first low, but which augmented as it approached; it gradually de ded toward the ground, and a light was perceived to issue from it, like that w accompanies the smoke of a great fire. After the passage of this cloud, a st odor of sulphur was perceived, like that which is diffused in places that have struck by lightning. The cloud had a very rapid motion, and formed rou a whirlwind, which extended to a distance of above a hundred yards round force of which was so prodigious that it tore up trees by the roots, carried awa roofs of houses, overturned buildings, and scattered their ruins to a distan 500 yards. After having moved along half a league with a width of above yards, it was dissipated, followed by heavy rain, but not accompanied by thu or lightning.

Upon the steppes of South America, whirlwinds raise the sand in the for immense pillars or columns, whose base reach to the clouds above, and the extends to the ground, they move in a gyratory motion, with the noise of di thunder. Similar appearances are often observed upon our own dusty roads, w paper, sticks and even limbs of trees are taken up and sucked into the revo funnel or colnmn of sand.

At sea a cloud is seen to send down toward the surface of the water a s column or funnel shaped cone, while the water immediately beneath the clo voilently agitated and rises in a cylindrical column or pillar toward the pen column of water attached to the overhanging cloud, in a few seconds the

columns of water meet, and the water from the sea is seen rapidly ascending through the compleated column, from the ocean to the cloud, in a spiral and circular motion, while the column is encircled with a depressed bowl or basin on the surface of the sea; after a time the whole column becomes detached from the ocean, and is drawn up into the cloud. This phenomena is generally followed by a violent shower of rain, its duration is from a few seconds to a half an hour, in which case the column often advances with the wind and cloud.

A land spout or whirlwind formed near Esclades, a small cloud approaching from the west gradully overspread the entire heavens, a column descended from this cloud presenting its vortex downward, and having its base in the cloud; this meteor in its course beat down houses, tore up great trees by the roots, globes of fire and sulphurous vapor were seen from time to time to issue from its centre, its rapid course was attended by a noise like a heavy carriage rumbling over a paved road, and it sucked or drew into its column of aqueous vapor the dust, sticks and other materials that came within its track, whirling them around and throwing them at great distances. Hail and rain fell in torrents after it passed.

All the phenomena of water spouts appear to be accompanied by electricity. When the column of water in a spout over the sea begins to form, the sea at its base is agitated for a distance of some 120 yards diameter, the waves tending toward the centre seeming to leap, accompanied by spray, to the revolving column. The column appears darker at the outside and light-blue, almost transparent, in the centre, as if it was a hollow cylinder, or the larger portion of spray and water were carried up on the margins, or exterior portions of the cylinder.

Sometimes when a cloud is over the sea the water is seen to rise up in a pillar toward the cloud, before the cloud sends its column downwards to the sea. But generally the cloud is seen to send its cylinder downwards first. These pillars are from a few feet in diameter to fifty feet, and vary in height from two or three hundred to over two thousand feet.

A whirlwind visited Aude, which is thus described—It commenced by pouring down a great quantity of water; it then lifted upward a great quantity of sand, which had the appearance of a column reaching from the clouds above to the earth below, it unroofed eighty houses, and scattered over the country the sheaves of corn, which it carried away, it tore up by the roots large oaks, and transported to a distance of fifty yards their branches, projecting them in a direction contrary to their own motion. It broke the doors, windows and furniture of a chateau; it destroyed the pavement in the middle of a room, without deranging china cups which were placed there; it broke the frame of a looking-glass, which was placed upon a chimney-piece, and scattered the fragments upon the chairs of the room, leaving the glass, however, in its place uninjured.

A land spout formed in the plain of Ossonval, and is thus described by an eyewitness—Clouds coming from different directions, and collecting over the plain, ultimately coalasced and formed a single cloud, which covered the heavens. Immediately afterwards a cone descended from this cloud, presenting its vorte downward, and having its base in the cloud. This meteor, driven by the wind

beat down a barn, tore and carried away the tops of the largest trees, overtu
twenty-five to thirty of them, and strewed them in different directions, pro
that the meteor had a revolving motion. It carried away, and crushed other tr
from 60 to 70 feet high. Globes of fire and sulphurous vapor were seen f
time to time to issue from its centre. This meteor in its rapid course was atter
with a sound like that of a heavy carriage rolling on a paved road. In
instance upon record, of the appearance of a whirlwind, accompanied by a re
ving column of sand, which occured in France, a man was taken up and whi
oilently around, and finally thrown against a rock, killing him instantly, in
forty sheep were killed, several houses entirely demolished, and
excavated for the depth of 20 feet. The entire phenomena lasted on
minutes.

The columns raised by whirlwinds always present the same general forma
contour, they consist of a hollow cone, sometimes straight, often curv
of the circular or axial motion they pursue an onward course, o
han ten miles an hour, sometimes much slower, so that a man can ea
pace with one while walking. As has been already stated, they are acc
with thunder, lightning and other electrical phenomena, constitu
centre of an aerial commotion, all around the focus of which a profound c
It is said that whirlwind columns, whether they eventually bec
or not, always originate on land or in the vicinity of land, where
vind and temperature are mutable. Occasionally when already formed, they
be destroyed by a voilent aerial commotion, such as is occasioned by firing a
non at them.

PROGRESS IN GEOLOGICAL INVESTIGATION.

Geology "the youngest of the sciences" now holds a high and well des
ed rank. It is defined as the science of the structure of the earth, but
investigations into the structure of a body necessarily carry us further and
to the inquiry as to the origin of such structure. Theories and speculations
be of no effect unless substantiated by facts, which to our human intelligence
regarded as incontrovertible evidence of the truth of such theories. And th
what geology presents us—"It finds strata of sandstone, clay, rock and limes
lying above one another in many successions; and observing them in their or
it assumes, not only that the sand-stone were made of sand by some slow proc
clayey rocks of clay, and so on, but that the strata were *successively* formed;
therefore they belong to *successive periods* of the earth's past; that consequently
lowest beds in a series were the *earliest* beds. * * * Thus every rock m
an epoch in the history; and groups of rocks, periods; and still larger groups, a
and so the ages which reach through geological time are represented in orde
the rocks that extend from the lowest to the uppermost of the series."—[*Da*

Thus we find that this science, through a recent outgrowth of human int
gence, has already become an exact science. That the undestroyed rem

of animal and vegetable life, and articles of domestic utility, found in strata so far beneath the present surface of our globe, and the formation of which strata must have occurred long before historic times, proves that the data are sufficient for the successful building of a theory. And the success attending the development of this science should act as an incentive to still further effort.

Wonderful are the additions that have been made to our store of knowledge by the geologists; they show us that our earth is "a very old world"; that instead of the once supposed date of 6000 years—*millions* of years must have elapsed since the creation; that man himself has lived upon the earth hundreds of thousands of years. The work of the rivers in excavating their beds, in forming their deltas, the remains of animals found imbedded in rocks, are so many milestones scattered upon the highway of time, to tell us of the lapse of ages, from these symbols the hireoglyphic writings of old time are interpreted, and his wonderful story unfolded to our inquiring gaze.

As we of the present generation regard with intelligent minds the various, and it would seem almost insurperable, obstacles which history shows us has ever been opposed to human progress, we cannot but exclaim that the limit to which man's intelligence, inventive power, and genius will carry him, has not yet been reached; and the future, dim as it now appears to us, will, no doubt, open to our successors a broad and unlimited field of labor—a field in which achievements no less grand, no less beautiful, no less useful, will be prosecuted with the same vigor, and results obtained which will make the greatest efforts of to-day appear but as the endeavors of a child. We are one of those persons who believe in the gradual, constant and permanent progression of the human race; an advance towards all that is best, both morally, intellectually and physically.

We do not think that the human intellect has at present attained its highest developement; no, it has only began to be developed.

The possibilities, indeed the certainties, of the future assume such proportions as to be almost, if not quite, beyond our comprehension. To be sure man's intelligence is finite and as all finite things have a beginning and an end, so also must this. We have Divine authority for saying that man was created in the image of his Maker; but it is not for us to say to what extent he may have received Divine attributes. It is sufficient for us to believe that the edict is "thus far shalt thou go and no further." That limit, wherever it may be, is still in the far future. There still exists within his grasp the germ of that which will in the future shape itself into a tangible form and material element and redound to the comfort, the happiness and the well-being of the entire human family. As it has been in the past so we have every reason to think—indeed it is our only means by which we judge—it will be in the future. The constant tendency of intelligence is forward towards perfection, and it is immaterial to us whether great occasions create great men or great men are created for great occasions; the fact remains that whenever a great result is to be accomplished, the intellect and the occasion in due time appear. Trace down all the grand results of history and you will find that they have been accomplished only at such time when the average intellect was able to comprehend them in all their bearings. Grand achievements are not the result

of sudden and spasmodic efforts, but rather of the education of the intelle
the plane on which the desired object lies; and it is to the constant, pers
application of this intelligence that we in civilized lands owe much of our
and happiness. It is extremely interesting to note the gradual progress a
different stages through which all inventions must pass. Way back in t
vista of the past, as far as written story will tell us, and further still guided
science of Geology, we to-day find the rudiments, the beginnings, of wh
since become developed and made conducive to man's wants. By this
we learn of the time when man existed merely as an animal; when he d
caves and lived upon fruits and the flesh of wild animals; when his want
few and his means of gratifying them fewer still; when his social and intel
natures were entirely subordinate to his grosser instincts; when in fact
merely the form of a man without his nobler qualities developed. From
the progress is gradual through what is known as the Stone age, and la
Bronze age, and still later the Iron age; all of these names are given fr
materials of which his instruments were made, and which latter are still
undestroyed by the lapse of time. And so of all things, even the science
beginning were there, and, though at the present time their elucidation has
would seem, in some instances most thoroughly accomplished, the gran
most certainly has not been reached. Within the time of authenticated
the story is the same. Columbus did not dream of the existence of a new
nent, but was led into the belief by the comprehensive study of facts
observed. The steam engine was not the outgrowth of one mind, but the th
understanding and practical application by Watts of principals pre
announced. Man's physical nature can by no means be considered as
reached its highest development. And the best possible condition would
that which contributes the largest muscle and the most active state of the n
and circulatory systems, but rather in the perfect harmony of action of al
for one desired end; of the disappearance of all hereditary and many ac
diseases, and the attainment, by all persons, of the Scriptural limit of
score and ten."

The consideration of his moral nature belongs properly to Theology.
as undoubtedly the progress in this branch has been, it is a sad commentar
man's nature to believe that much, very much still remains to be done.

The atrocities of the man Piper, or the boy Pomeroy, cause us almost
spair of ever reaching the highest level, and we can only explain these a
by applying to such persons the epithet, as given by Dr. O. W. Holm
"Moral idiots."

Notwithstanding all the discouragements presented, no other conclusi
be drawn than that which regards the human race as progressive, and as
cing, with great strides, toward the attainment of the grand object, for wh
was created. The end is not yet, nor is it possible for mortal man to ca
horiscope; but when, in His own good time all things are made perfect, th
the Millennium come, and the highest possible development of man's moral
be attained.

T. A.

PERMANENT ICE IN A MINE IN THE ROCKY MOUNTAINS.

Geologists have been not a little perplexed with the frozen rocks found in some of our silver mines in Clear Creek County, Colorado. I will first give a statement of the facts in the case, and then a theory for their explanation. There is a silver mine high up on McClellan mountain, called the Stevens mine. The altitude of the mountain is twelve thousand five hundred feet. At the depth of from sixty to two hundred feet the crevice matter, consisting of silica, calcite, and ore, together with the surrounding wall-rocks, is found to be in a solid, frozen mass. McClellan mountain is one of the highest western spurs of the Snowy Range; it has the form of a horse-shoe, with a bold escarpment of feldspathic rock nearly two thousand feet high, which in some places is nearly perpendicular. The Stevens mine is situated in the southwestern bed of the great horse-shoe; it opens from the northwest. A tunnel is driven into the mountain, on the lode, where the rock is almost perpendicular. Nothing unusual occurred until a distance of some eighty or ninety feet was made, and then the frozen territory was reached, and it has continued for over two hundred feet. There are no indications of a thaw, summer or winter; the whole frozen territory is surrounded by hard, massive rock, and the lode itself is as hard and solid as the rock. The miners being unable to excavate the frozen material by pick or drill to get out the ore (for it is a lode, running argentiferous galena from five to one thousand two hundred ounces to the ton), found the only way was to kindle a large wood fire against the back end of the tunnel, and thus thaw the frozen material, and in the morning take out the disintegrated ore. This has been the mode of mining for more than two years. The tunnel is over two hundred feet deep, and there is no diminution of the frost; it seems to be rather increasing. There is, so far as we could see, no opening or channel through which the frost could possibly reach such a depth from the surface.

From what we know of the depth to which frost usually penetrates into the earth, it does not appear probable that it could have reached the depth of two hundred feet through the solid rock in the Stevens mine, nor even through the crevice-matter of the lode, which, as we have stated, is as hard as the rock itself.

The idea, then, of the frost reaching such a depth from the outside being utterly untenable, I can do no other way than to fall back upon the Glacial Era of the Quaternary. Evidences of the Glacial Period are found all over the Rocky Mountains. Just above the Stevens mine there are the remains of a moraine nearly a mile long, and half a mile wide. The *debris* of this moraine consists of small square and angular stones, clearly showing that they have not come from any great distance. And just over the range, on the Pacific slope, there are the remains of the largest moraine I have ever seen, consisting of feldspathic boulders of immense size.

I conclude, therefore, that it was during the period of intense cold that the frost penetrated so far down into these rocks, and that it has been there ever since, and bids fair to remain for a long time to come.—*By* R. WEISER, *Georgetown, Colorado, in "Journal of Science," December*, 1874.

PROPOSITIONS CONCERNING THE MOTION OF CONTINEN GLACIERS.

PROF. N. S. SHALER.

Ever since I have become convinced that the surface of North Am north of the parallel of 40°, was covered to a great depth by a mass of ice c the last glacial period, I have been constantly endeavoring to form a conc as to the nature of its movement. This problem, which has doubtless led naturalists into similar difficulties, has, it seems to me, some light thrown u by the considerations I shall summarize in this paper. It is evident tha angle of declivity of the slopes over which the ice movement of the glacial p extended can not account for the motion. There is, for instance, indub evidence that during the last glacial period the country between Cincinnati, and the Laurentian Mountains, was deeply ice-wrapped, and that at the time we had a great amount of material from the Canadian section transpor the Ohio Valley.

We also have evidence that the ice-sheet furrowed the surface as if i moved as a continuous, or tolerably continuous mass, and it has therefore assumed, it seems to me hastily, that the behavior of a continential glacier have been essentially the same as that of a valley glacier, *i. e.*, that it had a tinuous movement from the innermost point to the border.

In the following considerations I hope to make it evident that this s sition of the continuous movement which should bring any particle of ic a distance of say eight hundred miles from the Laurentian Mountains to the is not necessary to the explanation of the facts.

Mr. James Thompson has already shown from theoretical consideration the influence of pressure in causing water to melt at lower temperature tha Fahr., is considerable; his paper, too elaborate to be considered in detail leads to the conclusion that for each atmosphere of pressure the freezing would be lowered by the amount of 0.0075 of a degree Centigrade. Now, suppose the surface of any country to be buried beneath an ice-sheet, it is that insomuch as a glacial mass of great thickness is generally nearly level surface, however irregular the earth beneath it may be, it follows that the sure at different points on the floor of the glacier must vary more or less, ac ing to the difference in depth between the highest and lowest points of the surface. Now, assuming that the glacial sheet has a uniform temperature thr out its lower portion, the gradually increasing pressure as the ice contiu heap up, will bring about melting from the pressure alone at the base of th cier. The amount of pressure necessary to bring about this melting will d upon the normal temperature of the ice at the point of contact with the if the temperature be assumed as 30° Fahr., then the ice must be about two thick in order to cause melting by the pressure alone. The probabilitie however, that the temperature is generally nearer 32° than 30° Fahr., so th

mass of ice would have to be much less thick in order to bring about this melting action. It is hardly worth while to undertake calculations as to the precise thickness of required ice on this basis of reckoning; for the data are not sufficiently clear to admit of certainty as to the precise amount of pressure necessary to lower the melting point of ice of a given temperature. It is evident, however, that a thickness of ice may be readily attained which will cause ice having a normal temperature of 28° to 30° Fahr., to melt by pressure. Let us now consider what would be the effect of melting under these conditions. It is evident that, inasmuch as the fluidity of any water melted by pressure depends upon that pressure being continued, the passage of this melted water upwards through the crevices of the ice would not be possible; water mounting through the crevices of the ice would at once have its pressure removed, and would freeze again. The movement would evidently have to be in the direction of the least resistance, or toward the section where the ice was thinner than at the point of melting. The actual amount of the movement possible to water under these conditions would be very small, but in the continual recurrence and cessation of strains these slight movements would integrate themselves into a steady transfer of water toward the border of the glacier. The occurrence of these meltings, and the accompanying change of volume in different parts of the ice-sheet, would necessarily have the effect of continually altering the tensions in all parts of the mass; this change would be exceedingly favorable to the creation of a constant succession of tensions, and the consequent frequent melting and freezing of the water. One of the first consequences will be to reduce the aggregate friction of the base of the ice upon the earth, on account of the ice being essentially afloat whenever this melting occurs beneath it, the soldering of every crevice in the superincumbent ice being assured by the freezing of the water as soon as released from the superincumbent pressure. Another important effect would arise from the penetration of the earth to great depths by the glacial water injected by a pressure equal to the weight of the whole thickness of the ice-sheet. If a reservoir of water was formed beneath the ice in any depression the result would be, in case of the long retention of the water, that its temperature would become considerably elevated above the point at which it was made molten by pressure. If, now, the barrier separating this mass of water from a region of less pressure even be taken away, there would be a rush of water in that direction, which might assume great importance as an erosive and transporting agent.

I have long remarked, in the study of our American moraines, that by far the larger part of the pebbles were water-worn, and that scratched specimens, even in regions high above the sea, where marine action was quite out of the question, and did not form more than one per cent., often not one tenth of one per cent. of the whole mass. It is well-nigh impossible to account for this great abundance of rounded pebbles without supposing there were powerful currents of water beneath the glacial mass. It seems to me that the melting of the water by pressure, and the elevation of the temperature of this water by the heat generated by friction, or taken from the earth, would probably give us a sufficient move-

ment of water to produce continued or interrupted currents beneath a large of the ice-sheet. This will also help us to account for the formation of gl basins, and for the deep valleys of the Fjord Zone, inasmuch as melting o on account of the pressure; the points where the ice is deepest will be the p where the melting occurs most easily. Let us consider the condition of any lake-basin during the time when it was deeply covered with ice, and melting pressure was taking place therein. This basin would be the seat of much movement than the other parts of the glacier's base; the change in the cond of the water from solid to fluid would inevitably lead to a certain waste of th at this point, to a continued tumbling in of the ice from above, and to an i sant sliding of ice from the sides; these changes would, on account of th quent alterations of the strains arising from the formation and breaking of a over the area of melting, occur with a certain paroxysmal force. These fre accidents in the glacial mass, together with the movement of the water, dr before it sand and pebbles, would necessarily add to the erosion of the point w they occurred. For every increase in the depth of the excavation, there woul a proportional increase in the intensity of the melting, arising mainly from deepening of the ice-section; but also, though in a comparatively small de from the greater heat in the bottom of the deepened pit, caused by its approx the central heat. To this we may safely attribute the singular depth of ma the lake-basins within the Fjord Zone—the deeper they became, the greate forces leading to their deepening. The limit to this increase of the intensi the deepening forces would be found in the formation of a pit on the surfa the ice just above the basin. The independence of movement in the bottom upper parts of the glacier-sheet would prevent the formation of a depressi the surface of the ice until the area of the basin grew quite large. The impo fact that all glacial lake-basins excavated in solid rock have their greatest leng the direction in which the ice-stream moved, shows us that there was some n sary connection between the movement and the formation of the basin; this c accounted for from the fact that the stream of water made fluid by the acti pressure would necessarily flow off in the direction of the border of the ice-s while the principal supply of ice must come from the direction in which it thickest. These two actions, arising from the entrance of the ice and its exit the basin, may well account for the elongation of these lake-basins in the dire of the ice movement.

The advantage of this view over that which seeks to explain the erosi those basins by the grinding of the ice alone, is, I think, manifest. The diffi with the latter view is to account for the rise of the ice from the basin aft descent into it. The shearing action would necessarily lead to the flow o upper level of ice over the part which was within the basin, leaving it lo within its walls. I do not mean to deny the value of this sort of excavating cess, as shown in the theory so long and ably presented by Ramsey, Mortillet others; I am inclined to think that it may have done much at certain stages o ice action to dig out basins, but in many cases it is manifestly inapplicable.

lake-basins of central New York, for instance, cannot possibly be explained on this basis. We must bring in some agent tending to cause melting at the base of the glacial mass, in order to effect the excavation of such basins. I am inclined to think that the other class of excavations of the Fjort Zone, the valleys which do not sink into the pit-like depressions which form the lakes, may also be, in fact, accounted for by the operations resulting from melting under pressure, for the coursing of floods of water, released by pressure from its solid state, would prove a powerful aid to the excavating action of the ice.

By supposing that the principal transporting action of a continental glacier was accomplished by the water flowing beneath the glaciers, we readily account for the water-worn look which is so pominent a feature in the drift pebbles of the greater part of North America; even when their position makes it clear that they have never been worked over by water since they were left by the glacier.

By this theory ws can account for the excavation of such great lake-basins as those occupied by the fresh water seas of North America. These basins, by their trend, and by their distribntion over a region where they cannot be explained by simple ice-erosion, present an insuperable difficulty to any view wbich does not admit that running water was largely concerned in their production. On the hypothesis here brought forward, we can, it seems to me, account for their formation. The sheet of ice which had its southern border on the Ohio, at Cincinnati, doubtless leveled over the great trough which separates the central part of that State from the Laurentian Mountains. This valley of the great lakes has a depth of at least six hundred feet below the table-land which separates the Ohio valley from Lake Erie. In this great depression we may have had melting occurring on a scale so vast as practically to arrest the southward movement of the ice, the sheet only overlapping in an unimportant way, and for a short part of the glacial period, the southward boundary of the valley. The southern discharge of these waters may have been in part through the river beds of the State of Ohio, but I am inclined to think that the larger part of the waste went to the eastward down to the valley of the St. Lawrence. This view I am, in a measure, compelled to take, on account of the relatively small amount of drift along the southern border of the glacial sheet in the State of Ohio. I do not believe that the excavated matter irom the basins of the great lakes is represented in the delta of the Misissiypi, nor in the surface-deposits of the country to the south of their southern border. When we look for this waste we possibly find it in the vast mass of the Newfoundland Banks, which seem to be a huge submerged moraine, or delta, which never could have been formed by the transporting power of the St. Lawrence acting as a river. In this fashion we may possibly account for the production of basins extending east and west, like the great lakes.

The question will be fairly asked, how it is possible for an ice-sheet to have produced striæ across the whole continent, from the Arctic Circle to the Ohio, unless it moved continuously over the whole of this long path? This may be answered as follows: If we suppose the retreat of the glaciers to have been accompanied by a true forward glacial movement of the region near the edge of

the sheet, we would have every part of the glaciated area in turn subjected to scratching, without the difficulty of supposing that there was a continuous mo over thousands of miles. I do not deny that the ordinary form of glacial mo took place along all parts of the border of the glacial sheet for many miles, bu assume that this movement took place in the basin of Lake Erie, while the gl front was at Cincinnati, seems quite unnecessary. I do deny that there is such terminal moraine along the southern border as is required if we suppose movement to have been continuous from the center of the sheet to the bor The whole of the facts may be accounted for by supposing that there was a mo near the border of the ice, possibly for many miles therefrom; but we are required to supposse more than this. Local movements of considerable stre there would undobtedly be within the mass of the glacier, and as long as t occurred near enough to the border to make the relief easier in that direct they would doubtless tend that way, but we must always remember that scrat alone give very insufficient evidence of the nature and extent of glacial moveme at best, they show us the direction of the very last movements that took p before the ice disappeared. Other erosion marks, like "crag and tail," doul tell more; but these features are probably the product of many successive gl periods, and not of the last alone. The evidence to my mind is irrefragable tha region had its essential topographical features, all its valleys and fjords before last ice time. Undoubtedly, in many successive periods we may have had en wearing applied to the hills to give them their form.

Some years ago I endeavored to account for the erosion of lake-basins of glacial period by the melting of the ice beneath the glacier from the outflow o ternal heat. This clearly is an insufficient cause to explain all the action, I still believe it to have been a true cause. Taking J. D. Meyer's computation, supposing that the waste of heat from the earth's interior is two hundred o miles per diem, one-half from volcanoes, there will be about one foot of ice mo beneath the continental glacier each year; as this heat will escape principall the bottom of the valleys, it will directly co-operate with the pressure mel As long as the water remained in the shape of ice, the escspe of heat from b would be in a measure retarded; the instant a part of this ice was melted water the escape of heat from the earth would be greatly aided, and would bec very rapidt and in this way the continued fluidity of ice rendered liquid by sure, would be secured.

These propositions may be briefly summed up as follows:—

1. That the melting caused by pressure would put a limit to the accu tion of ice at a depth of probably not exceeding two miles; probably much le

2. That while the ice resisted the passage of heat from the earth, the w would favor this action, and so enable the water, fluid from pressure, to mo regions a having considerable less pressure.

3. Some meltlng would take place beneath the ice from the heat of earth alone; this would, in itself, be sufficient to produce considerable effects

4. The melting from pressure would give the ice-sheet a chance to mov freely in the direction of least resistance. The water would not be able to ris through the unmelted ice on account of the removal of the pressure, to whicl owes its melting.

5. The flow of water, more or less spasmodic and flood-like, toward: border of the ice, would suffic to carry away the rain-fall of the reigon, anc push forward pebbles to great distances; it would account for the of moraine matter far above the sea, and for the rounding of pebbles.

6. The scoring of the rocks, which gives evidence of movement and of th direction whence it came, are necessarily the work of the retreating ice sheet, give no proof of the eondition during the time of its widest extention.

I should say that I have attentively considered the theory so ably by Mr. James Croll, wherein he seeks to explain the movement of glaciers by th successive melting of molecules of water in the passage of heat through the ice I am not prepared to deny that it may account for the motion of local glaciers but deem it quite insufficient to show us how the ice movement could carry snow formed a thousand miles north of the Ohio down to that river. Moreover as I before stated, I am satisfied from the paucity of the moraine matter in south ern Ohio and the neighboring region, that the movement had no such continuit as leads to the formation of a terminal moraine of a local glacier.

When the Humboldt glacier, and the other ice sheets of Greenland, come to be studied with care, I am inclined to beleive that the great streams of water which issue from beneath them will be found to owe their origin not alone to surface-melting, but also to the action of pressure-melting, and the melting from the passage of heat from the earth's interior into the ice mass.—*Proc. Bost. Soc. Nat. Hist.*

NOTES ON THE CAUSE AND GEOLOGICAL VALUE OF VARIATION IN RAINFALL.

BY PROF. N. S. SHALER.

The rainfall of the earth's surface is the most variable of all its conditions. Great as are the variations of temperature, they are relatively less considerable than the variation in the amount of moisture deposited. In the range from less than ten to over eight hundred inches, which can be found in one region within a few hundred miles, and in the considerable, though less striking, variation at many points on the earth's surface, we have a rate of difference many times greater than that whfch occurs in the range of temperature between the equator and the poles. There are two kinds of variation, both of geological interest, but belonging to different categories of facts. The first of these classes includes the variation due to change in the distribution of the rainfall of the earth, the quantity of that rainfall being the same; the second class includes the variations which arise from the differences in the amount of the total evaporation. The existence of

such variations may be regarded by some as a questionable matter; the evide
however, is great in quantity, and of the most distinct kind, going to show
in the immediate past the rainfall of the earth's surface was greater than
On every continent, save Europe and South America, we find closed ba
which show distinctly that there has been a gradual and progressive shrinkag
the waters within the time that has elapsed since the end of the glacial perioc
do not mean to maintain that the shrinkage of a salt lake after its separation
the sea, is a necessary consequence of a diminution of the rainfall. There
:t the present time, many regions of the ocean where the supply from the cl
s not sufficient to balance the evaporation. Many parts of the Mediterranea
)y some barrier from the general ocean, would begin rapidly to shrink
he state and dimensions of the Dead Sea; but a lake separated from the ocea
'arrier, and shrinking from a gradual abstraction of its water through eva
ion. the climate remaining the same, would probably retire slowly, and wi
steadiness from the time of its formation until it found itself, so to
the evaporation area just equaling the rainfull. But many, if not n
hese areas of excessive evaporations cut off from the general supply, show
of terraces which probably represent a succession of stages in the shrin
vhen, for a time, a balance was attained. These terraces are said, among
:ases, to be prominent on the basin of the Great Salt Lake.

Considering, for a moment, the case of this particular basin, we notice
he shirnkage is marked by terraces, said to be so distinct that I find it diff
.o believe that they were formed before the glacial period. If we accept t
the opinion that they were formed since the last ice time, we are driven to e
of two conclusions: that the basin was below the sea at the close of the gl
period, or that it has had its water supply greatly diminished since that time.
is manifest that the basin could not have been lowered into the sea durin
since, the last glacial period; so, granting the shrinkage phenomena to be re
we are driven to accept the conclusion that terrace levels are due to a re
diminution of rainfall. Much the same considerations will convince us
many other of the closed lake-basins of the earth represent a shrinkage of rai
in their regions, a shrinkage going on to the present day. Evidence
diminished rainfall are not wanting in many regions which have not been
into closed basins. The western shore of South America seems to have felt
effect of this shrinkage since the period of man. There are in Peru, for insta
evidences of extensive cultivation in the shape of artificial terraces, where ir
tion is impossible, and where no crops could be grown with the present rain
Similar and even stronger arguments could be drawn from the well known
given by the Caspian Sea and its neighborhood.

Without endeavoring, at present, to assemble all the evidence which p
to the diminution of rainfall, I propose now to consider what are the forces w
could bring about a change in the amount of rainfall in any country. There
evidently two ways in which the rainfall of a country may be modified: 1st.
the change in the distribution of the total rainfall of the earth; 2d, by the ch

in the actual amount of that rainfall through the reduction or increase of
tion. It is evident that these two sets of causes may, and doubtless do,
and interact to a greater or less extent, but this is a matter I do not intend
discuss.

Considering the first of these categories of causes, we see abundant
to show us that in the successive changes of level of the land, bringing every
of its surface at various times at different heights, we must have a most
cause of variation of rainfall. It may be safely said that a change of level of
hundred feet in any country would be necessarily attended by a perceptible
tion in its rainfall, while by a change of five hundred feet the effects might be
great importance in the distribution of animals and plants. The change of
height of other regions may have as important an influence as the elevation
depression of the given district. In fact, the interaction of these causes leads t
very complicated phenomena, which it is far beyond my purpose to consider.
is evident that they may be grouped together under the general term of the
ence of height. This is probably by far the greatest determining influence of
local kind.

Along with this cause comes the position of areas of evaporation; the heigh
and conditions of a country being unaltered in every regard, a variation in the
evaporation region which supplies it may have a great effect upon its rainfall. If
a considerable part of the evaporation areas supplying North America became
dry land, the effect must be great without any co-operating action occurring on
the continent itself.

Change in the direction or force of ocean currents would also have great
effects. When the Japan current entered the Arctic Ocean, giving that region
the warmth it had when its vegetation resembled that existing in the Mississippi
Valley at the present time, there probably was a material increase of the rainfall
there, and probably a diminution of the deposition in the tropical region, caused
by the considerable lowering of heat in that region, while a large part of its
temperature was being dissipated in the Arctic Ocean. These considerations
seem to confirm us in our belief in the very great variability of the conditions
which affect the distribution of the rainfall, assuming it to remain constant over
the world at large. Enough has been written concerning the influence of forests,
etc., to make it unnecessary to advert to these influences in this paper.

Turning now to the conditions which may affect the total amount of water
lifted from the earth's surface during the year, we come to a class of questions
which have been very little considered by meteorologists, and possibly with good
reasons, since the main aim of the real advancers of that science is to keep out
of the field of pure coujecture. It will, I trust, be evident, however, that some-
thing can be gained from a glance at this question without becoming too specula-
tive in our considerations.

The most material influence which can come from the elevations and depres
sions of the land on the total rainfall, will, in the main, arise from the following
causes:—

1. The narrowing or widening of the evaporation area.

2. The restrictions put upon the passage of marine currents by the for the land.

I am inclined to think that the first of these actions may have consider value. For instance, if the lands of the tropical regions have been steadily inc ing in area ever since an early geological period, a proposition which could fi good deal of support, then the total evaporation area and the consequent rai nust have been diminishing. Even supposing the Lyellian hypothesis to be t he amount of land and water to remain the same, the total evaporation w greatly effected by changes which should accumulate the water area abou or about the equator.

The effects of the obstruction of oceanic currents are not less important ust suggested. If, by any cause, as, for instance, from the barring of currents in their northward course, as the Japan current is now barred, only extensive scale, the oceanic streams were kept more within the equatorial at present, the result would probably be a slight diminution of the mount of rainfall.

These causes, through greatly affecting the distribution of the rain, mus he whole, have comparatively little effect upon the aggregate rainfall. I nclined to think that the main cause must be sought in the alterations in the which comes to the earth from the sun. Although some importance has ttached to the accession of heat from extensive and prolonged volcanic erup t does not appear that this can be a great cause, for Mayer's computation s hat, at present, the quantity of heat received from the earth's interior ca amount to more than one-sixtieth of the total heat that comes to its surface. the variation in the supply from the sun is a possible cause that has been but considered. The fact that the limited time that has elapsed since star maps been made has shown us very many variable stars of exceedingly different pe of variation, some passing regularly through a cycle of change, and some va in what seems to be a paroxysmal manner, may well make us question wheth is not in the nature of stars to be variable, and whether this variability does belong to our sun as well. It should be noticed that slight variations are prob more likely to occur than great changes, and that to bring about great altera in the earth's conditions, we need only changes which would not materially the brilliancy of our sun, as seen from the distance at which we behold the stars. The heat of the sun could be increased by twenty-five per cent. wi materially changing the magnitude of the sun as a star.

In a previous communication, I have called attention to this cause as a p ble source of the climatic changes of the glacial period, the invasions of ice l brought about by the sudden increase of the precipitation of water in high latit due to an increase of heat and a consequent increase of rainfall. If we take view of the cause of the glacial conditions, then the existence of evidence o diminution of rainfall during the time since the close of the glacial period, bec a matter of the greatest interest. While the whole question is involved in greatest doubt, as I have tried to show in the first parts of these notes, I

inclined to think that there is some evidence to be drawn from the physical recor left in our salt lake basins to indicate the great probability of a diminution o rainfall since the last ice time.

Besides this physical evidence of the change in rainfall, the palæontologica record supplies us with some evidence of a valuable kind, looking in the sam direction. Whenever we trace back the history of any of our land mammals, w generally find the variety of representative species which was in existence during, or just at the close of the glacial period, showing by its size or by its distributio that the conditions of environment were those which gave a very abundant supply of food. These conditions could not have been those brought about by greater mear annual cold, but must have been the result of climatic conditions, such as woul be caused by greater rainfall, and less range of temperature between winter an summer.

In various discussions of this subject, I have attributed the great transportatio of water from the equatorial to the polar regions, assumed to have occurred during that period, to the increased difference of temperature between these region during, at least, the first stages of a glacial period, and the consequent increase in the activity of the trade winds; it being assumed that, owning to the formation of a cloud-wrap about each pole, the equator would gain more in heat from an increase in heat of the sun, than the circumpolar regions.

The winter of 1874–75 having been unusually severe throughout the northern part of the northern hemisphere, it seemed likely that we should, if the foregoing hypothesis were true, find some trace of the effects arising from this temporary increase of the difference between the polar and equatorial conditions, corresponding to that greater change which was assumed to have taken place during the glacial time. In a word, if the average of rainfall is the result of the trade and counter-trade winds, and their products the sea currents, and if these winds are measured in their force by the difference of temperature between the equatorial and polar districts, then the period of very low temperature which, in the winter of 1874–5, prevailed throughout the northern hemisphere, should have brought a season of great rainfall in its train. Allowing six months for the completion of the trade wind circuit, we would expect the return of this rush of counter-trades, with their load of water, in the midsummer of 1875. It may have been only a coincidence, but it is a noteworthy fact that this season was one of the rainiest ever known in the northern hemisphere. It will at least make it desirable to compare the winter and summer temperatures and the rainfall over a considerable time. Following this same line of conjecture one step farther, I may notice that the annual rainfall during the winter seasons immediately preceding the extremely cold season of 1874–5 had been much less than usual. This gives a basis for the hypothesis that one of the cycles of change in climate may be something like this: a progressive diminution of rainfall in the circumpolar region, a consequent decrease of the cloud envelop of that region, and increased loss of heat by radiation leading to an intensification of cold, and that in turn bringing about an increase in trade wind and consequent greater rainfall. This rainfall will bring up the polar temperatur

diminish the difference in heat between that region and the equatorial belt, wh the trade winds will slacken, and the circumpolar rainfall again diminish, b ing again increase of radiation and lowering of temperature.

This is, I acknowledge, highly conjectural, but in the present state of question of climate, while too much value must not be given to conjecture, it yet have some value. As regards the geological effect of rainfall, there is point of considerable importance to which attention has not yet been directe refer to the great difference in the rate of wearing at different points, due to action of the different rates of rainfall. In our country, for instance, the re west of the Mississippi is, as a whole, wearing at only about one half the rat the region east of that belt. If this is continued for only ten million years effect will be to make a great difference of the height of the two regions.—*Bost. Soc. Nat. Hist.*

CHANGE.

Change is a universal law of nature. Nothing is permanent and unalter from the passing cloud which is never of the same shape, density or consist to the seemingly solid, permanent and "everlasting" hills. Nothing in nat unalterable; change is a symbol of the entire creation.

The surface of the earth is constantly undergoing a change, being worn d and tending to become a dead level, a plain.

The agencies at work which are effecting this change are atmospheric, aqu igneous and organic.

The atmosphere produces both chemical and mechanical effects, consistin it does, of nitrogen 79 parts, oxygen 21 parts, and carbonic acid 1 part. thousand with a variable quantity of watery vapor, it produces great effects rocks. Many minerals are acted upon chemically by oxygen and carbonic Sulphuret of iron (iron pyrites), when exposed to moist air undergoes decom tion. These chemical changes are followed by a crumbling—disintegration the rocks, a reduction to powder.

Winds modify the surface of the earth by drifting sand and gravel, from place to another. The erosive power of wind loaded with sand or gravel rocks is very great. Sharp edges are soon worn away and rounded off; the strata are eaten away and ridges and depressions produced in the surface of and upon the face of rocky walls. The effect of these sand blasts are well sh upon our western coasts.—The joint action of the waves and winds buil immense sand banks and ridges upon various sea coasts, while inland winds sandy plains and deserts effect astonishing changes.

The sands of the Lybian desert have buried ancient cities and templ Egypt. In Brittany, of a whole village overwhelmed by drifting sands, nothi visable above the surface but the spire of a church.

Frost exerts a powerful effect in producing a change upon the face o earth by disintegrating rocks. When water that has entered the fissures or

of rocks freezes, it expands with a force great enough to rend to pieces the strongest rocks, each fragment is again subject to the same process until it is reduced to powder.

Aqueous agencies, rain and snow, are constantly at work levelling the mountains and hills; piece by piece, grain by grain they disintegrate and carry the particles to the plains below. Every freshet, every mountain torrent carries down masses of rocks and soil until in course of time great changes are apparent. Every river is constantly at work levelling the face of the earth, excavating its bed and carrying immense quantities of material down to its mouth, where in course of time large deposits are made, forming deltas. The Mississippi river is said to discharge 28,188,083,892 cubic feet of sediment annually. One cubic mile is formed in five years and eighty-one days. The quantity annually discharged is sufficient to cover a township five miles square with a layer of mud 40 feet thick.

Aqueous agencies are exerted chemically, dissolving and decomposing rocks, or mechanically abrading and removing their particles. Water is the most general solvent power known, and is constantly at work dissolving and washing away the rocks and soil. Rivers and streams are most efficient agencies in wearing down and leveling the surface of the earth, and transporting the material. Their eroding power is increased by the friction of the ice, sand and rocks, carried along by the current of the water. This is exemplified upon a grand scale by large waterfalls. The falls of Niagara are 150 feet high, and the average amount of water passing over each minute, is estimated at six hundred and seventy thousand tons. The position of the falls is not stationary, but the eroding action of the water has worn away the rocks until the falls have receded fifty yards in forty years; they were originally situated at Queenstown, seven miles below. This process of erosion is still in progress, the falls are constantly wearing away the rocks, and the conclusion is inevitable that in process of time they will recede until they are reduced to a mere rapid, at the head of the river.

The immense amount of sediment brought down by rivers and deposited at their mouths may be judged by their deltas. The delta of the Ganges commences 220 miles from the sea, and has a base of 200 miles; it renders the waters of the ocean turpid 60 miles from the coast.

The whole coast of Northern Central Europe from Calais to the Baltic has been covered with mud brought down by the Rhine, and is many hundred feet thick.

Another efficient mode by which water acts, is in smoothing the surface of the earth by land slides. The water percolates through the earth where the upper strata rests upon a porous layer, as sand, which itsself lays upon clay, a substance which is comparitively inpervious to water, the water accumulates upon the bed of clay and from this issues in the form of springs, washing away the sand and thus undermining the upper beds. In 1806 the Rossbeg, a mountain in Switzerland, was undermined, and a mass of two thousand millions of cubic feet precipitated into the valley below, forming hills 200 feet high, and destroying many villages.

Glaciers are another active means at work; they carry great quantities of rocks and earth down to the valleys below, while the rocks, over which glacier

pass, are smoothed, scratched and grooved by sand and angular stones, f forward by the enormous pessure. These groves are parallel to each other, be the fragments which produce them are fixed in the bottom of the glacier. glaciers, formed in high latitudes, near the sea, fragments are broken off b waves, and falling into the ocean form icebergs. These, carrying great quar of rock and soil, brought down by the glaciers, are carried, by the ocean cur south, to warmer localities, where they melt and deposit their loads of mi upon the bed of the sea, often forming large banks. In this way is thoug have risen the banks of New Foundland. Here the icebergs meeting the current of the gulf stream, melt and deposit their loads. These icebergs are of great size. One measured fourteen miles in length, and one hundred and feet above the water.

The agency of the Ocean is like that of Rivers, twofold, erosive, we away the coasts, undermining and excavating cliffs, and transporting the mat and accumulating the detrius to form new land. These effects are produce tides, waves and currents. The action of the waves is incesssant, but as motion, in the open sea, is not progressive, and they do not penetrate very they do not effect the bottom of the ocean, except where it is very shoal. hardest rocks cannot resist their never ceasing attacks. Where the shore is posed of alternate strata of hard and soft rocks, the action of the waves in we away the softer rock produces caverns, crevices and pillars of fantastic s Headlands of alternate soft and hard rock are worn away with great rapidity. cliffs of Yorkshire, England, are ascertained by measurement, repeated after vals of several years, worn away six feet in breadth, annually. Many inst are on record, where islands and important towns have been entirely oblit by the action of the sea. The effect of this constant abrasion on exposed c is remarkably prominent, and is seen in the production of caverns, bridge isolated pinnacles of rocks. At Cape May, on the north side of Delaware the sea has encroached upon the land at the rate of nine feet in a year. In places its advancement is much more rapid. At Sullivan's Island, South Car it is at the rate of four hundred and forty feet a year. The waves of inland and lakes produce similar effects. They are constantly wearing away the c and transporting the material to other places, until, in course of time, the of the shore is entirely changed. These effects of the waves are much enh by storms. Masses of rock, of many tons in weight, are forced up an in shore. The tides of the ocean produce very marked effects in extending the of the ocean. The action of the tidal wave is alternate, advancing and rec destroying as it advances, and bearing away the debris as it recedes. Thus ing from currents, which carry the fragments which they produce, or meet only in the direction of their course.

The bore is a term applied to the sudden influx of the tide into a riv strait, which being resisted by the outflowing current of the descending wate forced into a narrow channel, rises suddenly, and exhibits the phenome

breakers upon a shelving shore. It is very destructive, sweeping off trees, rocks and animals. The bore at the mouth of the Severn is often nine feet high; that in the Bay of Funday seventy; that at the mouth of the Amazon is also very great. In the Hoogly Branch of the Ganges the bore travels 70 miles in four hours, and appears as a liquid wall five feet high. Marine currents perform a very great effect in altering the topography of the earth.

As tides and currents powerfully co-operate with waves in destroying and eating away the shores of the ocean, so also do they conspire in reproducing land, forming banks, and filling up bays and inlets. The water of the ocean holds a great quantity of detrius in suspension, geathered by its waves and currents from the shores, and brought down by streams and rivers; as this foreign material is constantly being deposited upon its bottom, there is a constant shower of fine particles upon the basin of the ocean.

The general result of the tamosphere and aqueous agencies is the reduction, the leveling of the elevated portions of the earth; their tendency is to smooth over the surface, to reduce it to a plain. The loss of land through their influence is greatly in excess over all deposits in the form of dry land, consequently a large portion of the detrius is spread over the bottom of lakes and the ocean.

While this process of leveling or smoothing down the surface of the earth is being carried on by the elements as above described, there are other forces at work in the interior of the earth building up and elevating the surface. Many portions of the earth are gradually rising. While the tendency of the atmospheric and aqueous agencies is to destroy and smooth over the inequalities of the earth's surface, and deposit the materials thus accumulated at the mouths of rivers, and at the bottom of lakes and seas, an antagonist force, the igneous agency, is as constantly operating to restore and reproduce these inequalities. This agency is exhibited in volcanoes, earthquakes, hot springs and gradual or sudden elevations of the land. Volcanoes are openings in the earth, through which melted rock—called lava,—ashes and gases are discharged, the flow of lava is often so great as to cover immense tracts of country, burying cities and villages, filling up valleys and lakes, and encroaching upon the sea. These eruptions of volcanoes are often teriffic in force. That of Sumbawa, in 1815, is an example; the explosions were heard in Sumatra, 970 miles west, and at Ternato, 720 miles east of the volcano; the ashes were carried over 300 miles in sufficient quantities to produce darkness equal to that of the darkest night; the floating cinders west of Sumatra formed a mass upon the surface of the sea, two feet thick and several miles in extent, through which ships forced their way with difficulty. The streams of lava covered extensive tracts of land and ran into the sea; the area convulsed was 1,000 miles in circumfrance; out of a population of 12,000 only 26 survived. The agency of earthquakes in altering the face of the earth is great and remarkable; large tracts of country are suddenly elevated or depressed, lakes and rivers are swallowed up or new ones formed, hills and mountains are sometimes elevated, and the entire topographical features of the land altered, and when it is known

that not a day passes without a shock of more or less severity in some part world, some idea of their power in effecting changes in the face of the eart be had.

Hot springs deposit silicious matter and often destroy vegetation aroun outlets, and thus exert some effect in producing a change in the aspect of scape.

Raised beeches and sea shells far inland are evidence of the gradual el of land. While this is now progressing in various regions of the earth, a ponding subsidance of the land is in progress in other regions. The north- coast of the United States is supposed to be gradually elevating, while th of Greenland is sinking. On the coast of Europe and America are fou marine forests, depressed many feet below the surface of the ocean.

Organic agencies, animals and plants, exercise a more or less marke ence in modifying the crust of the earth. Coral animals are constantly at v building up islands and continents. The remains of terrestrial plants ent the composition of soils and form extensive beds of peat and muck in s they also form great deposit of coal.

Animal and vegetable remains frequently make up a large portion of ex rock formations; the ocean is continually droping small shells upon its which, in the course of ages, accumulate to a great depth.

Man himself is a powerful agent in modifying the face of nature: h the elevations, and fills up the depressions, he excavates tunnels and dee changes water courses, and destroys forests. By boring wells in desert wa induces vegetation and verdure where before was only a barren and desert. The building of the Suez canal has induced green trees and bl flowers to grow where once was nothing but a barren sandy waste.

The erosive power of water, when in the form of running streams, is e fied in the cannons of the western portions of the United States. Here, in the of ages, streams have excavated channels from 1,500 to 4,000 feet deep, the surface of the earth, in many places, with space only wide enough stream, and with walls perfectly perpendicular.

Rain, by washing away the soil and rocks, is also, continually at work ling the surface of the earth.

Thus, by this short and imperfect summary of agencies at work, do that the face of Nature, the solid earth, the everlasting hills, the solid rocks symbols of unchanging solidity and firmness, are continually undergoing c

Animal life itself is not stable. The existance of species is not perm Many species have already become extinct, and others are daily becoming and it is only a question of time, when they will be obliterated from the the earth. The Bison, the Beaver and many others, once so nnmerous, ar in many localities, becoming rare. Many species have become extinct with toric times, and others are becoming so scarce, that it is only a question o when they will be swept from the face of the earth, and the places whic knew them will know them no more. The Seal and Whale are already s places where once numerous. Many plants have become rare or extinct.

Thus it is seen, that the universal law of change is apparent throughout all portions of nature, and its effects felt everywhere, from the humble, crawling insect to the great whale, from the mighty mountain, that lifts its proud snow capped head to the clouds, to the tiny pebble on the sea shore. Yet in all these changes, there is shown a grand and comprehensive plan, that includes, not only this world, with its millions of teeming inhabitants, but myriads of other worlds, larger and grander than ours. What a being must it be, that can at one, and the same time, heed and care for the microscopic being, that crawls unseen on the tiny leaf, and is crushed undeeded beneath our feet, and the revolving worlds in the heavens. O Lord, wonderful are Thy works, and past finding out!

OCEANIC MOVEMENTS.

BY J. MANFORD KERR.

MINOR MOVEMENTS—(*Concluded.*)—EARTHQUAKE WAVES. *

Earthquake waves may be defined as the manifestations of the disturbance of marine equilibrium by subterranean forces. The force operating may be immense or trivial, producing a shock which disturbes a hemisphere, causing whole mountains to swoop vale-wards, or a pulsatory throb which disseminates its force unperceived even by the inhabitants of the immediate region disturbed.

In the busy bustle of the world all terrestrial commotions are lost in the strife and turmoil of business, or soon pass from the memory of man or his chronicles of transpiring occurrences, except such as are indelibly impressed upon the records of time by destruction of property or human life. But aside from those vehement seismic oscillations which raze whole cities to the ground, topple mountains into the valleys, and traverse the plains and savannas with rents, chasms, and fissures, there are a multitude of inferior pulsations, which preserve the rocky crust of the earth in an almost constant state of vibration. It is true that the majority—a majority approximating to the sum total—of these inferior pulsasations pass unobserved save by those who are ever on the alert to detect the occurrence of just such insignificant phenomena, and who have provided themselves with those sensitive instruments of experiment and observation which the ingenuity of genius has invented, and the progression of art and the skill of man perfected, and which are so extremely sensitive as to be susceptible of recording the most minute oscillation of the earth's crust.

The extensive and scrupulously minute observations of M. D'Abbadie with seismological and micrometrical instruments, have all but incontrovertibly established the fact that the surface of the earth—which our imaginations depict as an impersonation of staunchness and durability, when we compare it with the extreme mobility of the circumambient air which incarcerates it, or of the liquid

* This paper, to preserve the logical and (implicitly) stipulated sequence, should have followed the one on 'Common Waves' and preceded those on 'Tidal Waves' and 'Surface Currents.'

ocean which bathes its surface—is in a state of constant vibration. The int of absolute repose which he noted, never exceeded one day and one-quarter

Each pulsatory oscillation, howsoever gentle it may be, manifests itself mobile waters of the ocean. The disturbance of aqueous equilibrium is p tionate to the vigor of the throb—to the extent of the oscillation produced l vibratory movement; and the vigor of the throb depends upon the amo subterranean force exerted.

The origin of these subterranean forces has long been a much moote vexed question, and at present is far from being a scientifically ascertaine All hypotheses agree in attributing them to "volcanic agency." This is an unsatisfactory phase, one which too frequently confounds the *manifestat the force with the force itself.* Volcanic eruption is no more the potential ca earthquake shocks, than the overt act which manifests sin in the individual origin of the sin. As the overt act simply manifests sin in the individual world—simply indicates the prior operation of a force which is generally d inated 'evil,' and which exists as a constitutional fact in the bosom of every vidual—so volcanic eruption is simply a manifestation of a prior operati subterranean forces, and not the cause of them.

The savants who have accepted the "*pyriphlegeton*" hypothesis, or do of a central mass of molten matter, describe these vibrations as the reperc of the undulations of the internal molten sea. But this theory of a central though the most plausible that has yet been afforded, and the solitary on accounts, even approximately, for the various planetary phenomena, is not pletely satisfactory; there are a great many cases it does not meet—phenom does not explain. But this objection could be made with more justice agains other system of cosmogony that has been introduced into the world of specu and been discarded, or that does at present exist. All systems of cosmogony that of the untutored savage who ignorantly but confidently supposes the p ary system to be the result of a fit of sneezing of the all-ruling spirit to whi renders savage homage to that of the great Buffon, according to whose theo the planets are the fragments of the wreck produced by the collision of a c and the great central orb of our solar system,—all the hypotheses from inchoate speculations of the ancients to the conclusions of modern scienc absolutely unconfirmed and unconfirmable.

We accept, therefore, this doctrine of a central fire, not because there is satisfactory demonstration of absolute truth, but because the whole realm of ulation or absolute knowledge affords a more plausible, or one competent t explanation of a greater number of physical phenomena. This theory reigns a realm of speculation where the attainment of absolute knowledge is as u impossible as it is to determine the physique of a human soul, or the "transp of a single *furture* event. A human soul is immaterial, intangible, aerial unsubstantial; unconditioned in time and unlimited in space; material, tan things which are both limited in time and conditioned in space, alone are c zable by the understanding of man; ergo, a human soul is not a subject of

knowledge. Man's knowledge is limited to the present and past. Anything which lies one hair's breadth beyond the present is entirely beyond the pale to which the utmost stretch of human knowledge extends—is shrouded within the inscrutable gloom of the unknowable. We no more know that to-morrow's sun will rise, or that to-morrow itself will put in an appearance, than we know that the brilliant orb of to-day will continue to dispense light, caloric, and fructifying power for milleniums unnumbered; or that this midnight it will terrify our antipodes by a meridinal descent into the Celestial empire. The past and the present alone are certain and knowable, the future—so far as man is coneerned—is contingent and suppositional; it may be seeable with the sharpened vision of reliant faith, but is not cognizable to the understanding.

This molten internal sea has its tides, currents and storms, similar to the external aqueous ocean. The reactions of these movements produce those surface oscillations already referred to, multitudes of which are lost to the generality of mankind—drowned in the bustle and business of the cities, and known only to that class of experimentalists and observers, who are ever on the alert and alive to the least deviation of nature from her wonted course.

Earthquakes have been looked upon by some as the result of volcanic eruption. The reverse is nearer the truth—volcanic eruptions are the result of earthquakes; yet neither is strictly true, for we may have an earthquake without an eruption or an eruption without an earthquake. Some of the severest earthquake shocks that have ever visited the earth occurred in districts devoid of volcanoes. Algeria, in Africa, although totally devoid of volcanic fissures of any kind, is yet frequently severely shaken. The regions of the Nile are likewise devoid of volcanoes, and yet subject to earthquakes. In South America the most frequent shocks have taken place along the foot of the Andes, while in North America earthquake oscillations are most frequent in ths alluvial plains of the Misssippi valley. The history of earthquakes evinces the fact that countries the most diverse in physical condition are visited by these destructive phenomena, and also that the shocks are more frequent in mountainous than flat countries. And again there may be an eruption of smoke, ashes, lava and gas, with no perceptible seismological disturbance. The most notable instance of a phenomena of this kind is probably the eruption of Vesuvius in May, 1855, at which time it is said to have vomited forth a considerable quantity of lava without the least trace of any motion of the ground being perceived either in the observatory on the volcano or at Naples.

It is undoubtedly true that in a great many instances eruptions are the legitimate effect of subterranean disturbances,—that the volcanoes are conduits or "safety valves," as they have been denominated by some scientific writers, through which the pent-up subterranean forces find their way to the outer world. That the reverse of this—*i. e.*, that volcanic eruptions produce earthquakes—is never true, we presume will be questioned by no one.

Such grand phenomena as earthquakes—phenomena that frequently culminate in catastrophes which destroy thousands of human beings—have attracted the

attention of mankind in all ages of the world. Near two thousand years ag great atheistic Roman poet,—Lucretius,—who was deeply imbued with the osophy of Greece, and an enthusiastic disciple of Epicurus, promulgate hypothesis which in all time has suggested itself to the mind of man, and which is to this day adhered to by persons of authority in the scientific wor such as Boussingault, Volger and Virlet. Lucretius set forth his theory abo follows.

"Learn, now, the cause of earthquakes, and first be assured that the in of the globe is, like the surface, filled with winds, caverns, lakes, preci rocks, and a large number of rivers, the impetuous waves of which hurry alo their course numerous submerged blocks. The shakings of the surface o globe are occasioned by the falling in of enormous caverns which time has ceeded in destroying.. While mountains thus sink in ruin, the violent and su shock is spread far and wide in terrible vibrations. Thus a chariot, the weig which, however, is not very considerable, makes all the houses near tremble passes, and the fiery steeds, drawing behind them the iron-armed wheels, all the places round. It might well happen that an enormous mass of earth s fall by reason of decay, into some great subterranean lake, and that the should tremble in a series of undulations. In like manner, on the surface o earth, a vessel filled with liquid in a state of agitation cannot resume its eq rium until the water contained in it has found its level."

A modern scientific writer of repute in speaking of this theory of the he poet, says: "In a vast number of cases this theory is certainly the true one. is often possible to catch in the act, so to speak, the phenomena which give to the oscillations of the ground and subterranean thunders. These great slips, such as those of the Diablerets, Rossberg, and other mountains of the have caused real earthquakes, the waves of which were felt at a considerable dis from the scene of the catastrophe. Even the falls of *moraines*, *seracs*, and av ches of snow, shake the ground very severely over considerable areas, so mu that in the mountains of Allemont, in Dauphiny, the inhabitants consider al vibrations of the ground as the reverberations of distant down-falls of sno rock."

It appears to be indisputably demonstrated that earthquake phenomen the result of the operation of various causes, some subterranean and others nal. It is an unquestionable fact, however, that all the greatly destructive trophes of earthquake phenomena follow such vibrations only as are the resu subterranean convulsions. Those surface shocks produced by the operati external causes are generally very restricted, comparitively harmless, and seldom rise to the grandeur of an earthquake.

THE PYRAMID OF MYCERINUS.

The *Tribune* of the 3d of May gave an account of the recent discovery by Chabas, the distinguished French scholar, of an old Egyptian astronomical table which has furnished the means for ascertaining the era of Mycerinus, the builder of the small pyramid of Ghizeh. The astronomy of the ancient Egyptians was almost marvelous in its exactness, when we consider their lack of all but the rudest mechanical appliances. They, first of all races, adopted a solar year of 365 days, and they also compensated for the odd hours which we dispose of in our leap years, by the very peculiarity in their calendar which has led to the discovery of M. Chabas. That is, the beginning of their year was fixed by the heliacal rising of the star *Sothis* (Sirius)—the day when it became visible immediately before sunrise. This heliacal rising varies slightly from year to year, and in a cycle of 1,244 years comes around to the same day of the same month. Thus the Egyptian calendar added one year in every 1,244, instead of one year in every 1,460, as occurs in ours from the sum of 365 leap years. That this was the result of careful calculation, and not a mere coincidence, is made evident by the fact that the Egyptians discovered and calculated, although not very correctly, the period of the procession of the Equinoxes.

M. Chabas states that the heliacal rising of Sirius mentioned in the papyrus took place on the 9th of *Epiphi*, which was the eleventh Egyptian month. Now, it happens that the rising took place on the same day of the same month, during a year so much later, that the day itself may be determined. In fact, any record of the rising—that is, the commencement of the Egyptian year—during the reigns of the Ptolemies, would be sufficient to fix the date. We suspect that the report is slightly inaccurate in this respect, and that it means simply to say that the day indicated by the 9th *Epiphi* is settled by the later and accepted chronology. The cycle of 1,244 years gives the rest. M. Chabas is positive that the ninth year of the reign of Mycerinus falls between the years 307 and 310 B. C. All the details of the calculation, no less than the language of the original manuscript, will undoubtedly be subject to a rigorous test; but since the researches of Mariette and the historical studies of Brugsch and Ebers, the age given to the third pyramid will surprise no one.—*N. Y. Tribune.*

THE STINGING TREE.

One of the torments to which the traveler is subjected in the North Australian scrubs is the stinging tree (*Urtica gigans*), which is very abundant, and ranges in size from a large shrub of thirty feet in hight to a small plant measuring only a few inches. Its leaf is large and peculiar, from being covered with a short silvery hair, which, when shaken, emits fine pungent dust, most irritable to the skin and nostrils. If touched it causes the most acute pain, which is felt for months afterwards—a

dull, gnawing pain, accompanied by a burning sensation, particularly in the sl der and under the arm, where small lumps often arise. Even when the sting quite died away, the unwary bushman is forcibly reminded of his indiscretion time that the affected part is brought into contact with water. The fruit is pink, fleshy color, and so inviting that a stranger is irresistibly tempted to pluc but seldom more than once, for, though the rasp-berry-like berries are harmles themselves, some contact with the leaves is almost unavoidable. The blacks said to eat the fruit, but for this I cannot vouch, though I have tasted one or tw odd times, and found them very pleasant. The worst of this nettle is the tend t exhibits to shoot up wherever a clearing has been effected. In passing a dray-tracks cut through the scrub, great caution was necessary to avoid oung plants that cropped up even in a few weeks. I have never known a ca being fatal to human beings, but I have seen people subjected by it to great notably a scientific gentleman, who plucked off a branch and carried it s istance as a curiosity, wondering the while what caused the pain and numbne arm. Horses I have seen die in agony from the sting, the wounded parts oming paralyzed; but, strange to say, it does not seem to injure cattle, who hrough the shrubs full of it without receiving any damage. This curious anoi s well known to all bushmen.—*Cassell's Illustrated Travels.*

CAVE FAUNA OF THE MIDDLE STATES.

Through recent investigations of scientists, the number of animals know inhabit our caves has been greatly increased—in many instances doubled. the Mammoth Cave the number is quite doubled. In Carter's Caves, Gra County, Kentucky, a rich fauna of twenty species was discovered.

These researches show a great uniformity in the distribution of life. though these caves lie in a faunal region nearly identical as regards the exte world, and the temperature is very constant. Still some notable differences o

Of plant life, three forms of low fungoid plants occur in the Mammoth other caves, on old pieces of wood, but not in sufficient abundance to suppor animal life of the caves, which is nearly all carnivorous, or, as in the cas the poduras and snails, live upon decaying wood, aritficialy introduced the cave. The chief support of all animal life in these caves is probably living and decaying animal and vegetable life found therein.

The lowest worm observed was a perfectly white planarian, with no vi eye-specks, and a quarter of an inch long. The common earth worm was obse in all the caves, but in the innermost recesses of the Mammoth Cave was n dwarfed, not above half an inch long. Many species of spiders, species of H Protozoa (the lowest form of these last being a vibrio, with a pear-shaped l with a number of vacuoles). Blind crawfish, and a rare scolopendrella l been noted in these caves. In all, there were added 50 species to the nu previously known to inhabit our caves, the former number of cave inhabit being 30.

LAKE NYASSA. (CENTRAL AFRICA.)

This lake is found by recent discoverers to be much larger than Livingstone supposed it to be. The nothern extremity is nine degrees, 20 minutes south latitute. A large number of beautiful islands have been discovered, and at north-eastern end, there is a range of mountains 10,000 to 12,000 feet above the level of the lake, extending for a hundred miles. The shores are clothed with verdure, and the water is clear and very deep, at several places within one hundred fathoms of the shore, lines of a hundred fathoms failed to touch the bottom

The population around the shores of the lake once supposed to be very dense, has been greatly thinned by the Arabs, who have carried off and sold into slavery great numbers of the people. For many miles along the north-east coast the sites of villiages were found, and the ground was strewn with thousands of human skeletons. The remnant that escaped are living in houses built on piles in the lake, or on rocks.

The lower half of the lake is in the possession of powerful chiefs, who with their people centred around them, aid the Arabs in prosecuting the nefarious trade, they have five large boats (dhows) and carry from 15,000 to 20,000 slaves across the lake every year. Kota Kota is the principal place for Arabs and slaves. —*Evangelist.*

THE CAVE OF CACAHUAMILPA.

The cave of Cacahuamilpa, Mexico is, perhaps, the largest in the world. A volcanic mountain, with an extinct crater, covers the cave. After descending some 50 feet, the visitor traverses a succession of immense halls and galleries, the roof of some of which is so lofty, that rockets often explode and fall before reaching the ceiling.

Labyrinthine passages extend from the main hall in every direction. Stalagmites and stalactites are numerous, and often of fantastic and beautiful shapes and forms. Underneath this cave, at great depths, are two other immense caves, from each of which issues a branch of a great river, that unites here. These two rivers enter the cave some five miles distant, on the other side of the mountain, flow parallel, and issue at last together. A great number of bats inhabit these caves.

The caves were explored by Mr. P. C. Bliss, twice. Upon the last exploring expedition, 600 persons constituted the party, who entered with Bengal lights and Scientific appliances, and their discoveries are given to the world in a report by Prof. Bliss, read before the Am. Association for the Advancement of Science.

NOTES.

Ever since the discovery, in the early days of telegraphing, that a return was needless, if the ends of the wire were sunk in the earth, electricians indulged in the hope that the earth could be made to carry the direct as we the return current, and that thus all telegraph wires could be dispensed Many experiments have been made to test the question, whether the return cu actually travels through the earth, back, between the stations, at which the en he wire are buried. These experiments have given results favorable to the l hat the current does so take its course, and unfavorable to the theory that equilibrium is restored simply by the excess or deficiency of electricity being o speak—lost in the great mass of electricity in the globe. It is well known, hat there are, at all times, electric currents in the earth, probably near its sur aside from those artificially produced. Their direction, strength and unifor have been, to some extent, ascertained and tabulated. Among their chief ca is reckoned, the frictional electricity, likely to be developed by the sweep o winds over the earth's surface. Very recently, a renewal has been made of efforts to utilize the currents. M. Bourbouze, who directed a series of experin of the sort, during the seige of Paris, has recently shown that sufficient power be obtained from earth currents to work telegraphic iustruments, where the source of power was from two iron stakes driven into the earth 11 yards a The experiments, during the seige, had reference to sending messages thr the earth, or preferably through water, without wires. Though moderately cessful, these attempts served to show that such a mode of sending signals w require, for long distances, enormous battery power. If the new experiments to a cheap means of obtaining abundant electric force, the problem of telegrap without wires may be in a fair way of solution. Earth, water or even air may be compelled to carry the electric message. That we are on the eve of a disc o of cheap sources of electricity seems not improbable. During great displa the aurora borealis, the electricity communicated from it to the wires has more than once utilized in this country to send messages. Another prom source of supply is very likely to be practically developed from experiment metallic plates sunk in the sea; the chemical changes being effected and electricity developed without any expense for salts or acids.—*Tribune.*

The voyage of the Challenger, an exploring vessel sent out by the Br Government, has been exceedingly valuable to science in determining ocean de and currents, ascertaining new facts concerning animal life in the sea, and thro new light on abstruse problems in geology, geodesy, and natural history. A ceedingly entertaining account of the voyage is given in *Nature* of June 1, acc panied by drawings of several of the newly-discovered animals, made from t

while living, under the microscope. These strange forms can be compared with nothing that the average reader is likely to be acquainted with, except perhaps that some of them resemble figures occasionally obtained in a kaleidscope. The distance sailed was 68,930 miles; the voyage lasted three and a half years, and circumnavigated the globe. The deepest dredgings were at a depth of 3,150 fathoms, near the island of St. Thomas, W. I. A determination of the currents of the ocean has long been perceived to be essential to a correct knowledge of the changes in the atmosphere, the movements of cyclones, and a general comprehension of the meteorology of the globe. The contributions of the Challenger's voyage to this branch of knowledge alone must prove of great service in the direction that these studies are now taking; the hope being generally entertained that the advances of science will sooner or later give storm predictions for the whole world.—*Tribune.*

A source of some wealth is the mining of ancient cedar trees in the swamps of New Jersey. In these swamps are buried immense trees at the depth of from three to eleven feet. These gigantic logs lie one across another, and are the remains of the growth of successive forests.

The mode of search for the logs is as follows, an iron rod is thrust into the soft mud over which water often lies to some depth. By several soundings the workman is able to ascertain how the tree lies, which is its top and how large it is. He then obtains a chip of the tree, by which he knows if it is worth obtaining. A pit is dug, into which the water flows. Soon filling it to the brim. The trunk is now cut into sections, each piece floating to the surface. From three to four layers of such trees are found lying one on top of another, while large living trees are still growing over all, clearly indicating that many thousands of years must have elapsed since the first of these ancient forests were destroyed.

Remains of many beautiful species of coral have been discovered in the State of Ohio, also the remains of a mammoth and extinct species of Bever (Castorides Ohioensis), an extinct species of large wild hog, or Peccary (Dicotyles Compressus) a large elephant, the mastodom, and extinct species of horse, musk ox, reindeer, bison and a true ox, besides many other curious and extinct species of animals, showing conclusively that the climate was once far different from that prevaling at present, and that at different periods strange and gigantic animals roamed over the fertile plains and along the hillsides of Ohio.

The coal meausures of Ohio are very rich in fossil plants, many beautiful ferns and other equally fine plants, new to science are described in the late report upon the Geology of that State, which is richly embelished with splendid plates and diagrams.

Collections recently made under the direction of Prof. Newberry have added very much to our knowledge of the extinct species of Batrachia, the number of species found in Ohio is 34, referred to 17 genera.

REVIEWS AND LITERARY NOTICES.

VACCINATION AS A PREVENTIVE OF SMALL-POX—By W. C. Chapman, M Brown & Faunce, Toledo, 1876. An exhaustive treatise upon the subject, should be read by every physician.

AN ESSAY ON SCIENCE AND THEOLOGY—By J. M. Kerr. This much v question is here ably treated by that fluent writer, J. M. Kerr, so well and f ably known to the readers of THE SCIENTIFIC MONTHLY.

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VOL. 1. No. 11.

AUGUST, 1870.

THE SCIENTIFIC MONTHLY

A MAGAZINE DEVOTED TO

The Natural Sciences.

E. H. FITCH, Editor and Proprietor.

TOLEDO, OHIO:
TOLEDO COMMERCIAL COMPANY, PRINTERS.

The Scientific Monthly.

VOL. I. NO. 11.

Price, $3.00 a Year; or, 30 Cents a Number.

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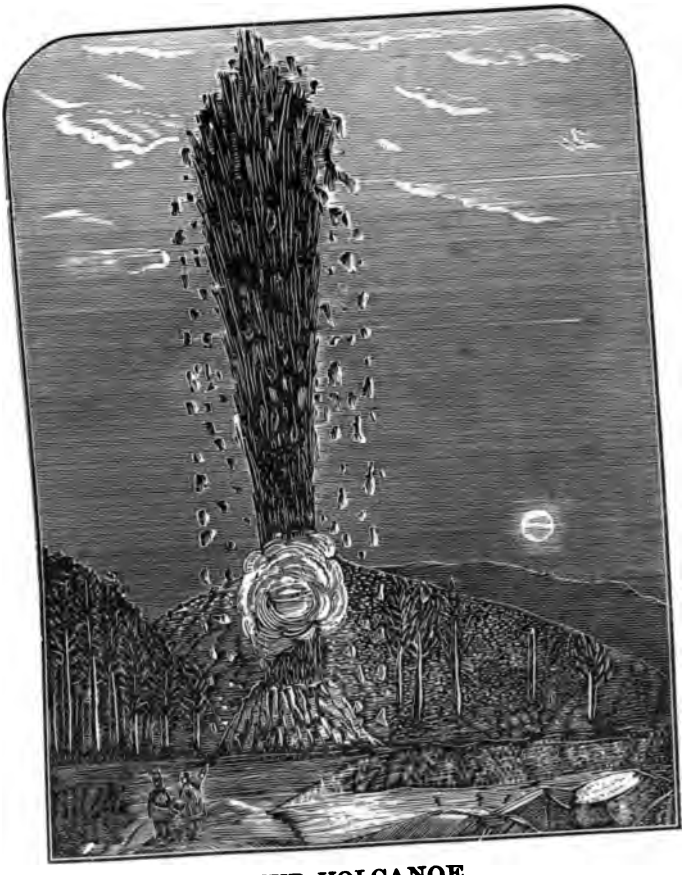

MUD VOLCANOE.

Yellow Stone Region, U. S. A.

The Scientific Monthly

DEVOTED TO THE NATURAL SCIENCES.

VOL. I. AUGUST, 1876. NO

SPRINGS—Continued.

T. A. FELCH, M. D.

Thermal springs afford a very interesting subject of study. Any spring w is regarded as thermal whose temperature exceeds that of the surrounding a ground. Perhaps 85° F. would be a proper limit to fix as a standard, an below this must be considered as temperate or cold springs. As may readil conceived the zone of mean temperature, that is, the distance beneath the su at which an unvarying temperature is found, varies in different localities. In G Britain it is between 200 and 300 feet, in Paris about 50 feet and the same tance in many parts of this continent. From that distance as a standpoint found that there is a steady increase of temperature of 1° F. for every 52 fe descent. Therefore it may be said, in a general way, that the degree of wa shown by the water upon its emergence may be taken as an indication of the d of its source. But that would be a statement to which there are some excepti for there are other causes which influence the amount of heat. First, the w must be thoroughly and equally heated in its subterranean reservoirs; secon must have a free and direct communication from its origin to its exit; and t it must be present in such quantities and be expelled with such force as will en it to retain its heat within itself and impart the least possible amount to the co strata and water above. These conditions, accordingly as they are fulfilled m or less perfectly, give us the different grades of thermal springs. All degree temperature are represented, from the slightly warm to the boiling water.

Arago has estimated that at a depth of 3,000 feet the water would have a perature of 200° F. "In Siberia Magnus found a gain of 15° F. in descen 407 feet, equal to 1° F. for 27 feet. The rate of 1° F. for 52 feet of descen

the latitude of New York would give heat enough to boil water at a depth of 8,100 feet, and 3,000° F., the fusing point of iron, at a depth of 28 miles."—*Dana.*

The phenomena of the flow of naturally heated water from the earth has been the subject of speculation from a very early date, and attempts have been made to explain it upon the principal of chemical changes taking place beneath the surface of the earth, and many ingenious theories have been advanced in its support. It is assumed that chemical changes take place beneath the snrface in local situations, and that these local chemical changes are sufficient to account for the many volcanic actions manifested; and, moreover, that to these chemical changes are attributed all the phenomena of central heat, hot springs, mud volcanoes, etc.

The chemical theory might, indeed, afford a satisfactory explanation of certain phenomena, but the theory most generally entertained and the one, seemingly, most entitled to credit, is that which regards the water as having been rendered warm or hot by contact with the heated strata or lava over which, in its subterranean passage, it courses. That they are of volcanic origin would seem to follow from the fact that they are found in regions of later geological formation, and where the country is of comparative recent volcanic origin.

"The theory of mountain building, advocated by Mrssrs. Hunt, Mallet and Le Conte, call mountain corrugations a result of mechanical work, due to horizontal pressure (a function of the secular cooling of the earth), and announces as a second result of the same work the development of heat in the loci of the work. It is held that in some places corrugation does not take place, but instead, there results a local crushing of the rock, accompanied by sufficient heat to produce local fusion and furnish material for volcanoes. If this be the true theory of volcanoes, then the equilibrium of the heat of the crust may be disturbed by the production of local *maxima*, not only where the rocks are pierced by molten dikes, but also in the places, not necessarily very deep-seated, where lava is found, and also along the axis of corrugation, and these regions would naturally contain hot springs. * * * The most intense action would be prodnced by recent dikes. Where the discharge is small, and the temperature high, the source of heat cannot be remote, else the heat would have been lost in transit; and, as this is the rule with geysers, they are probably regarded with propriety as strictly volcanic phenomena, indicating the recent injection near the surface of hot lava, whether or not it has been extruded."—*Gilbert.*

And as to the origin of volcanoes, the best received theory is that the center of the earth is in a fiery—a molten state—and that volcanoes are but the openings, chimneys or flues to this central sea of heated molten matter, and that from this source spring all the various phenomena of the increase of heat as we descend beneath the outer crust of the earth—of earthquakes, volcanoes, etc., etc.

A fact that gives strong support to the volcanic origin of thermal springs is that they are found in every instance in what are known as "corrugation" strata rather than in the eruptive strata. These corrugations are formed "through the diffusion of superheated steam at a high temperature, the rock may have derived increased inflexibility, so that a material otherwise unyielding, as limestone, was

flexed under the slowly acting pressure, without breaking. Metamorphic roc always displaced and folded, and never for any considerable distance horiz Where the foldings are most numerous and abrupt, reducing the strata to a of parallel dips by the pressing of fold upon fold, then the metamorphism is complete."—*Dana.*

In the United States thermal springs correspond exactly with these co tions. Corrugations do not exist on the plains of the Atlantic coast nor Mississippi region. Neither do thermal springs.

"The single locality in Arkansas is referrable to the Orchean Ozark co tion. We may consider the heat of springs in the Appalachians due en as argued by Rogers, to the normal, we might almost say static, downwa crease of temperature brought to bear by means of deep-seated water c following faults and curved strata."—*Gilbert.*

Accepting the volcanic theory in regard to hot springs, we would nat expect that the waters would be the warmest in the regions of latest geol formation. And such is in fact the case, as the following table of some thermal springs in the United States will show:

NAME.	LOCALITY.	T
New Lebanon	New York	
Bath	Virginia	
New Milford	Virginia	
Warm Springs	Virginia	
Hot Springs	Virginia	
Hot Springs	Arkansas	
Pyramid Lake	Nevada	
Yellowstone River	Wyoming	
Big Hole Prairie	Idaho	
Mound Sulphur Spring	Colorado	
Minersville	Utah	
Iemez	Santa Anna County, New Mexico	
Benton	Inyo County, California	

The solvent power of water in the cold state upon the dense rocks and is very limited; but when the water is heated this power is greatly increase it is then capable of holding in solution an immense quantity of solid ingre —even beyond the point of saturation. As the water evaporates and coo excess is deposited around the margin of the spring, and upon the surface ground along the course of the stream formed by the outflow of the water spring, if there be such, giving rise to mounds around the mouth of the s and encrusting all of the objects with which the water comes in contact.

In all the regions where geysers are found these mounds form a pe feature and are seen in all their stages of formation. One part of the fiel present the remains of what was once a large and mighty spring, now silei no longer active, and presenting in its well, it may be, only a placid surf beautifully clear blue water. Its mound may rise to the height of from c

twelve or more feet, and is composed of the material most abundently held in solution by the hot springs, viz.: silica. But the mounds made by the hot waters in the region of Gardner's River offer an exception; they are of a calcareous nature. These differences are owing to the geological formation of the strata over which the hot waters flow. Another locality will show the geyser in full height of its power, while in still another is an apparently new formation, just beginning to exhibit the phenomena of a flowing or boiling spring.

The Geysers are one of the forms of thermal springs and present many curious and astonishing phenomena. They are found in many different parts of our earth and in each place present certain features peculiar to that region. Is it not wonderful that in the cold and dreary arctic region of Iceland, where the snow and frozen waters exist as permanent adornments of the land, and the few short days designated out of courtesy Summer, are hardly sufficient to melt this investiture and give a start to vegetation in the sheltered valleys; is it not wonderful, that amid such surroundings there should burst from the earth water having the temperature above the boiling point? What contrast could be greater; and what could illustrate more forcibly the great diversity exhibited in all the workings of nature?

Formerly active geysers were found only in Iceland; lately, however, some exceedingly beautiful and grand fountains of this nature has been discovered in the island of New Zealand and later still adventurers in our own far western territories have discovered and described to us, regions of vast extent, *literally covered* with geysers in all stages of growth and activity, and which in size, power and magnitude of display, together with all those accessories which tend to make the scene at once sublime and awful, and stand without a parallel in the known world.

Colonel Barlow thus describes an eruption he witnessed in the Yellowstone basin, and which shows in a typical manner the action of all geysers: A roar was heard near the hillside a hundred yards distant, and upon rushing out in that direction we saw a huge mass of steam issuing from a crater-like hollow at the base of the hill, accompanied by a column of water rising to a height far exceeding that of any geysers yet seen. This grand fountain continued to play for several minutes, when, having subsided, I approached to obtain a closer view of the aperture whence had issued such a powerful stream. A sudden gush of steam drove me away, following which the water was again impelled upward far above the steam, until it seemed to have lost the controlling force of gravity. The roar was like the sound of a tornado, but there was no apparent effort—a steady stream, very graceful and perfectly vertical, except as a slight breeze may have wafted it to and fro. Strong and smooth, it continued to ascend, like the steam from a powerful steam fire engine. We were all lost in astonishment at the sudden and marvelous spectacle. I have no hesitency in stating that this geyser played to the height of over two hundred feet. It commenced at five o'clock in the afternoon and continued twenty minutes."

The Giantess, of which a fine illustration was given in the July number of the SCIENTIFIC MONTHLY, is an immense Geyser in the Yellowstone region a few

miles from Madison Lake. This spring, which throws the water to a heig 285 feet in an immense solid column, is one of the grandest sights of nature. orifiice of its tube is encircled by a rim or bank ten feet high.

Prof. Tyndall speaking of the Great Geyser of Iceland says: "It consis a tube seventy-four feet deep and ten feet in diameter; the tube is surmou by a basin which measures from north to south fifty-two feet across, and from to west sixty feet. The interior of the tube and basin are coated with a beau smooth silicious plaster, so hard as to resist the blow of a hammer; and the question is, how was this wonderful tube constructed—how was this pe plaster laid on? Chemical analysis shows that the water holds silica in solu and the conjecture might therefore arise that the water had deposited the against the sides of the tube and basin, but this is not the case, the water dep no sediment; no matter how long it may be kept, no solid substance is sepa from it. It may be bottled up and kept for years as clear as crystal wit showing the slightest tendency to form a precipitate. To answer the questic this way would moreover assume that the shaft was formed by some fo agency, and that the water merely lined it. The geysers basin, however, upon the summit of a mound about forty feet high, and is evident from inspection that *the mound has been deposited by the geyser;* but in building up mound the spring must have formed the tube which perforates the mound, hence the conclusion that the geyser is the architect of its own tube.

"If we place a quantity of geyser water in an evaporating basin the follo takes place: In the center of the basin the liquid deposits nothing, but the where it is drawn up by capillary attraction, and thus subjected to speedy eva ation, we find silica deposited. Round the edge a ring of silica is laid on, not until the evaporation has continued a considerable time do we find the slig turbidity in the middle of the water.

"This experiment is the microscopic representative of what occurs in Ice Imagine the case of a simple thermal silicious spring, whose waters trickle a a gentle enclosure, the water thus exposed evaporates speedily, and sili deposited. This deposit gradually elevates the side over which the water p until finally the latter has to take another course. The same takes place here ground is elevated as before, and the spring has to move forward. Thus compelled to travel round and round, discharging its silica and deepening shaft in which it dwells, until finally, in the course of ages, the simple spring produced this wonderful apparatus which has so long puzzled and astonished the traveler and the philosopher."—*Wonders of the Yellowstone.*

"The time required for the construction of the Great Geyser has been mated by Commander Forbes as ten or eleven centuries, on the following grou A bunch of grass, placed under a little fall made by the ejected water, rece in twenty-four hours, a coating of silica the thickness of a thin sheet of pape about one five hundredth part of an inch. At this rate it would take 1036 to build up the 762 inches, which, according to his measurement, is the dep the tube. In evidence of the probable truth of this estimate, he makes note o

following facts: first, there is no notice of this fountain in the early history of the colonization of the island 986 years ago, at which time the tube would have been only three feet deep, and its eruptions too slight to attract attention; second, 43(years afterwards, when the tube would have been twenty-six feet deep, and the eruptions proportionally important, this geyser is mentioned; third, accurate records of all occurences were kept by the early inhabitants, and if so remarkable a phenomenon had existed at the time, it would not have been left unnoticed."—*Richardson.*

This silicious deposit often assumes the most beautiful and variegated colors and tints. In the Yellowstone this is peculiarly marked; at one basin will be seen through the transparent waters, an exquisite rose-colored lining, at another bright red, one is a light green another golden and so on through many varieties. A most delicate tint of red is produced by a deposit of oxide of iron; sulpher causes exquisite shades of yellow. "Still others are stained with shades of green, all these colors are brilliant as the brightest aniline dyes."

Another singular feature is that though many hot springs contain enough foreign ingredients to be designated mineral, still in this region much of the water is clear, sparkling and free from taste, seeming to be remarkably free from harmful impurities and is most excellent for drinking and cooking purposes.

In the vicinity of all hot waters, holding silica in solution, a curious phenomenon occurs in the growth of the vegetation. Mosses, grass and trees undergo the process of petrifaction, and become converted substantially into a species of stone, still retaining, however, the form, appearance and structure which was characteristic of them when living vegetables. The silicious solution is absorbed by the circulating fluid of the plant and becomes deposited within its substance, effectually preventing the process of decay, and substituting the stony for the woody material.

In the territory of New Mexico large forests of this silicified wood of great perfection and beauty are still seen; tall trees still erect as in the vigor of their growth, stand as monuments of the time when that particular region was overflowed by the silicious waters. Certain parts of the region of the Yellowstone and other places in our Western territories, afford the same phenomenon, as also do, though on a smaller scale, the plants in the immidiate vicinity of the hot springs of Iceland and the Azores.

But geyser springs do not always emit water in its extreme fluid state, for in these western regions of comparatively recent formation, geologically speaking, there exist localities where the surface of the ground consists of a hardened crust of but a few inches in thickness, underneath which lies a vast quantity of soft tenacious mud. This substance heated to an extreme degree, presents conditions under which we would expect eruptions to occur. Such is indeed the case, and the phenomenon of "mud geysers" presents itself to our view.

"The contents of most of them were of the consistency of thick paint, which they greatly resemble, some being yellow, some pink, others red and some dark brown. This semi-fluid was boiling at a fearful rate, much after the fashion of a hasty-pudding in the last stages of completion. The bubbles, often two feet in

height, would explode with a puff, emitting at each time a villainous sme sulphuretted vapor. Springs six and eight feet in diameter, but four feet a der, presented distinct phenomenal characteristics. There was no conne between them, above or below. The sediment varied in color, and not u quently there would be an inequality of five feet in their surfaces; each, s ingly, was supplied with a separate force."—*Langford.*

"They seldom have any visible outlet, but are in constant agitation, wi sound which varies with the consistency of the contents; several give suppressed thud as the gases burst their way through the stiff mortar. Somet he mortar is as white as snow; sometimes brown or tinged with a variety of colors."—*Richardson.*

They throw the mud and semi-liquid substance to the height of from six hundred feet into the air, accompanied by loud explosions.

The following description of a mud geyser is given by Mr. Langford: A wo hundred yards from this cave is a most singular phenomenon, which we c Muddy Geyser. It presents a funnel-shaped orifice, in the midst of a l hundred and fifty feet in diameter, with sloping sides of clay and sand. rater or orifice, at the surface, is thirty by fifty feet in diameter. It tapers uniformly to the depth of about thirty feet, where the water may be seen, w he geyser is in repose, presenting a surface of six or seven feet in breadth. low of this geyser is regular every six hours. The water rises gradually, mencing to boil when about half way to the surface, and occasionally brea orth in great violence. When the crater is filled it is expelled from it in a sp ing, scattered mass, ten or fifteen feet in thickness, to the height of forty The water is of a dark lead color, and deposits the substance it holds in sol in the form of minute stalagmites upon the sides and top of the crater.

"While returning by a new route to our camp, dull, thundering sounds, w General Washburn likened to frequent discharges of a distant mortar, broke our ears. We followed their direction, and found them to proceed from a volcano, which occupied the slope of a small hill, embowered in a grove of p Dense volumes of steam shot into the air with each report, through a crater feet in diameter. The reports though irregular, occurred as often as every seconds, and could be distinctly heard half a mile. Each alternate report s the ground a distance of two hundred yards or more, and the massive jets of which accompanied them, burst forth like the smoke of burning gunpowder."

In many mud geysers the semi-fluid mud and water is ejected in such and dense masses, as to fall in clots or thick bunches; but is ejected with force as to be projected for more than one hundred feet into the air, accompa by a rumbling and explosive sound. Our illustration will give a fair idea of of these singular phenomena.

Bunsen's ingenious explanation of the manner and cause of the eruptio geysers, was given in a former article. It must be evident that as they owe action to the existence of internal fires, that the time will come in the far fut when this action will cease, and these phenomena become things of the pa

Concerning this Prof. Tyndall, says: A moment's reflection will suggest, there must be a limit to the operation of the geyser. When the tube has reached such an altitude that the water in the depths below, owing to the increased pressure, cannot attain its boiling point, the eruptions of necessity cease. The spring, however, continues to deposit its silica, and often forms a *Laug*, or cistern. Some of these in Iceland, are forty feet deep. Their beauty, according to Bunsen, is indescribable. Over the surface curls a light vapor; the water is of the purest azure, and tints with its lovely hue the fantastic incrustations on the cistern walls; while at the bottom is often seen the mouth of the once mighty geyser.

There are in Iceland, vast remains of once active, but now extinct geyser operations. Mounds are observed whose shafts are filled with rubbish, the water having forced a passage underneath, and retired to other scenes of action. We have in fact the geyser in its youth, manhood, old age and death, here presented to us. In its youth as a simple thermal spring; in its manhood as an eruptive column; in its old age as the tranquil *Laug*; while its death is recorded by the ruined shaft and mound, which testify the fact of its once active existence."

(*To be Continued.*)

SOMETHING ABOUT BATS.

Perhaps none of the wonderful creations of nature excite more interset and curiosity than the bat, seen in the dim obscurity of twilight or by the uncertain light of the moon, as it flits past us like some spirit or ghost, while it sails over head through the air upon noiseless unsteady wings, its broad membranous pinnions extended to their fullest extent, it naturally excites our curiosity and attention.

The bat from its habtt of resting among crumbling ruins, dark and damp caverns, and solitary grottoes, has long been an object of dread and suspicion to the uneducated. It seems to be a nondescript, to partake at one and the same time, of the nature of an animal and that of a bird, or rather to be the connecting link between birds and animals. Indeed in old times, naturalists seemed at a loss where to put the bat, and doubted whether it was a beast or a bird, that they were describing, possessing a body somewhat similar to a rat, covered with hair, having teeth, and bringing forth its young alive and suckling then at the breasts, it possesses no qualities similar to a bird, excepting its power of sustaining itself in the air in flight. So that now, no doubt can exist where to place the bat, it is universally placed among quadrupeds.

The bat of the temperate regions lives upon insects. It is strictly nocturnal in its habits, retiring to some dark and secluded place, such as a hollow tree, a cavern, or some deserted house or crumbling ruin, to rest and sleep by day, where it hangs by its hind feet, head downward to the wall, motionless, until the shades of night approach, when, after the sun has sank beneath the western horizon, it ventures forth upon noiseless flicking wing in pursuit of its insect prey. The bat makes its

first appearance early in summer, lying dormant during the winter month begins its flight in the dusk of the evening, frequenting the edges of forests, g and shady walks, and is also observed to skim over the surface of sheets of It pursues gnats, moths, and nocturnal insects of all kinds. If it happens interrupted in its flight and falls to the ground, it speedily resumes its arising with facility into the air. Its movements upon the ground are awl and slow. It appears only in the most pleasant evenings, when its prey is erally abroad, and flies in pursuit with its mouth wide open. Thus this creature spends but a short portion of its existence in action, lying dorman concealed in some cave or hollow tree during winter, and sleeping throughou hours of daylight, only venturing forth in calm, pleasant nights, and then short time only, retiring soon to its retreat to rest and sleep.

The bat couples and brings forth in summer, generally from two to five time. The female makes no nest, but is content with the first hole she meets where, fastening herself by her hooks to the wall of her apartment, she permi young to hang at the nipple, and in this manner to continue for the first or s day, when after some time, the mother becoming hungry, she takes her little and attaches them one by one to the wall, as she herself hung before, and they remain, clinging immovably to the wall, patiently awaiting her return.

The bat so active in the air, is awkward and ungainly upon the gr When the little animal attempts to walk, the wings are closed, and becom feet. The hook upon the outer end of one wing —the thumb—is attached to object and the body pulled forward and to one side, the next step being by ilar movement by means of the hook upon the other thumb. By means o uncertain, slow and diagonal movement of pulling forward alternately by thumb and then by the other, the bat progresses upon a level surface. movements in the air are free, easy and graceful, they turn and double in flight with facility. In the air they are perfectly free and at home. When they seek some dark secluded retreat, where they hang suspended by the feet, head downwards from the roof, whence, in case of necessity, they have to loose their hold, when their wings at once spread open and they begin flight.

The eyes of bats are small and bright. The bat may be described as a miferous quadruped, whose general form is disposed for flight. An expansi the skin of the body stretched between the four limbs, the greatly elongated fi of the anterior extremities, the two mammae of the breast, the clavicles very s the fore arm incapable of rotation in consequence of the union of the bone characteristic marks.

The bats are divided into two main divisions or groups, characterized l structure of the teeth. The first group consists of bats that live upon fruit, a the molar teeth with flat crowns, obliquely truncated and longitudinally gro three joints to the fingers, generally provided with a nail to the second f the tail wanting or rudimentary. This group consists of the genera pteropu cephalotes.

The second group comprise the true insectivorous bats, consisting of the genera, vespertilio, phyllostoma, nycteris, atalapha, corynorhinus, etc.

In general, the skeleton of the bat combines strength and lightness. The head is somewhat elongated (the longest in the fruit-eating bats). The portion of the temporal bone containing the organ of hearing is much developed. All have canine and incisor teeth, the latter varying in number from two to four in the upper and from two to six in the lower jaw. The molars also vary from three to six in each jaw. The vertebra of the neck are very broad; those of the back and loins simple, almost without spinous processes and much compressed at the sides. The sacrum is very long and narrow. The tail, when present, is short and used to extend the inter femoral membrane and direct the flight. The ribs and breast bone are long, the upper portion of the latter greatly expanded laterally to give a firm support to the strong collar bones. It has a raised ridge or keel in front, the same as in birds. The shoulder blade is highly developed, the arm bones greatly lengthened and very slender. The fore arm consists of the usual two bones, but the ulna is quite rudimentary, being also united to the radius. The radius is very long and robust, and cannot be rotated. The bones of all the fingers, except the thumb, are excessively lengthened for the attachment of the flying membrane. The thumb is short and provided with a hooked nail, by which the animal can climb walls or suspend itself. The thigh bone is of moderate size, and so turned that the front surface is directed backwards. The fibula is small and slender. The foot is normal in its development, but has an elongated, bony process upon the heel for the attachment of the membrane. The toes are five in number, nearly equal, and with hooked nails, by means of which they suspend themselves, head downwards, when at rest. In the insictivorous bats the eye is small, but is large in the fruit-eaters. The ear is greatly developed in the insect-eaters, but normal in the fruit-eaters. The organ of smell is acute. Bats have so great a development of the sense of touch, that they seem to be able to avoid obstacles in their flight with the utmost ease and precision, even when deprived of sight. Spallanzani was even led to the belief that bats possessed a sixth sense. Having stretched fine threads across a room, he put out the eyes of some bats, who, in their flight, avoided these obstacles with the greatest ease. Cuvier rightly attributed this acute perception to the extreme nicety of the sense of touch in the flying membrane. This membrane arises from the skin of the flanks, and consists of an "abdominal and a dorsal leaflet," united into an exceedingly thin and delicate net-work. It includes not only the arms, hands and fingers, but the hinder extremities, the legs, feet and tail, being prolonged, more or less according to the various genera, between the legs and spread to the length of the tail, forming a broad and extensive sensitive surface, entirely out of proportion to the size of the body. To increase its sensitiveness it is nearly or quite destitute of hair or fur. The bat is therefore made acquainted with the distance of bodies by the different modifications impressed upon its membrane by the impulses of the air. The spinal cord is much enlarged, in the lower cervical and dorsal region, from which arise the nerves of sensation distributed to the wings. In the Frugivorous bats the

stomach is complicated and has a long alimentary canal, while in the insectiv species the stomach is simple and the intestines short, like the carnivora.

In the United States all our bats belong to the insectivorous species, an small in size. But in South America and the West Indies there are many fruit-eating bats; in fact all the frugivorous bats are confined to tropical cli Among the fruit-eating bats is the genas phyllostoma, peculiar to South Am In these the tongue is furnished with a row of wart-like protuberances at its extremity, arranged in a circle, and forming a complete sucking tube, by me which these bats are enabled to suck the juice of fruit and the blood of an The vampire bat is a large species of the genus. Its natural food is insects, hard pressed it will suck the blood of poultry, cattle, and even of man. The bl obtained entirely by suction from the capaillary vessels and not through any w made by the teeth. The stories told by travelers of the bats destroying peo night by sucking their blood, fanning their victims into unconsciousness l flapping of their wings, are highly exaggerated and fabulous. The vamp entirely harmless, and not at all feared by the natives. Among other foreig is the genus nycteris, of Africa. In these bats the skin is extremely loos adheres to the body only at certain points, and by a loose cellular membran capable of being inflated with air by communication with the large cheek po This inflation may be carried to so great an extent that the animal resem balloon with head, feet and wings.

Among other large foreign bats are the rousettes, belonging to the pteropus, East India species. These are the largest of bats. The Kalo Java, measuring no less than five feet in extent of wings, the body bein feet long. They are fruit-eaters, and entirely harmless. In confinement th eat flesh, so that it is possible that in the wild state they may vary their that manner. They have a disagreeable odor, and most of them, like other fly at night, sleeping by day, clinging to trees by the hind feet, head dow But some of them fly in the bright sunshine of day. A few of them are u food by the natives.

In the genus macroglossus, of Java, there is only one species, which is three inches long, but the tongue can be protruded for more than two inch exists in large flocks, lives upon fruit, and is much dreaded from the quan destroys.

The genra phyllostoma and glossophaga, are found in South Americ both are addicted to sucking blood. They also eat insects. The genus derma and desmodus both suck the blood of their victims.

All the foregoing are foreign bats, inhabiting tropical countries. The l the United States all belong to the family of vespertillonidae. They are feeders, do not suck blood, and are all small and harmless creatures, sleepi day in hollow trees, caves and crevices in rocks, and going forth at night t upon insects.

The following are all the bats found in the United States east of the M River:

SUB-ORDER CHIROPTERA. (The Bats.)

THE ORDINARY BATS (*Family Vespertilionidæ.*)—Insectivorous bats, with the snout not appendaged, or merely with two lateral excrescences, wing membranes ample; tail always completely enclosed in the interfemoral membrane or only the last joint exserted.

THE TYPICAL BATS (*Genus Vespertillo*).—Cheeks without excrescences; ears moderate; incisors, two on each side in the upper jaw and three on each side in the lower jaw.

LITTLE BROWN BAT (*Vespertillo Subulatus*).—Teeth 38; molars six on each side in each jaw; ears aud wings thin; face small, fox like; high forehead and pointed snout; ears, large, oval, twice the height of the erect tragus; wings, naked; interfemoral membrane naked, except at base; face, whiskered; color, dull olive brown; length, three inches; extent, nine inches; tail, one and one-half inches. Everywhere abundant in North America.

SILVER BLACK BAT (*Vespertillio Noctivagans*).—Teeth 36; molars five on each side in upper jaw, six on each side in lower jaw; tragus almost as broad as high, scarcely one-third height of ear; femoral membrane entirely though scantily furred, fur long and silky, black, usually with silvery tips to the hairs; length three and one-half inches; extent of wings twelve inches; tail one and one-half inches; inhabits the entire United States.

GEORGIA BAT (*Vespertillio Georgianus*).—Teeth 34; molars five in the upper jaw on each side, and five on each side in lower jaw; tragus slender, erect, half the height of the auricle; upper incisors about equal in size; femoral membrane one-third furred; color dark reddish brown, brighter anteriorly; length three inches; extent nine inches; tail one and one-half inches; Maine to Texas, more common southwards.

DUSKY BAT, CAROLINA BAT (*V. Fuscus*).—Teeth 32; molars four on each side upper jaw, five each side lower jaw; tragus never pointed; never half as high as the auricle; wings naked; interfemoral membrane furred at base; ears more or less turned outwards; upper lateral incisors small, scarcely visible; color brown; length four inches; extent twelve inches; tail one and one-half inches; entire United States.

THE RED BATS (*Genus Atalapha*).—Incisors one on each side in the upper jaw, three on each side in the lower jaw.

TWILIGHT BAT (*Atalapha Crepuscularis*).—Teeth 30; molars four on each side in upper jaw, five on each side in lower jaw; upper incisors small; wings naked and interfemoral membrane nearly so; ears small and wide apart; a small wart above the eye; fur rather scanty. dark fawn color above passing into brownish below; length three and one-half inches; extent nine inches; tail one and one-half inches; inhabits the United States from Pennsylvania to Missouri and the South-west.

RED BAT (*A. Noveboracensis*).—Teeth 32; molars five each side in upper jaw, same below; upper incisors stout; interfemoral membrane hairy above, the wings, with furry patches; the fur of this species is long and silky, and is of a reddish

brown color, mostly white at the tips of the hairs; lips and ears not edged black; a whitish tuft at base of thumb; length three and three-fourths inc extent twelve inches; tail one and three-fourths inches; everywhere abundan the United States.

HOARY BAT (*A. Cinerens*).—Rich chocolate brown, overlaid with white; and ears marked with black; length five inches; extent fourteen inches; tail nd one-fourth inches; entire United States, rather northern, and a rare speci

BIG-EARED BATS (*Genus Corynorhinus*).—Cheeks with two large excrescen ars excessively large; an inch high; teeth 36; incisors two on each side ir aw, three on each side in lower jaw.

BIG-EARED BAT (*Corynorhynus Macrotis*).—Color blackish; fur soft and l hree and one-half inches; extent eleven inches; tail one and three-fou inhabits from Virginia to Missouri region and South.

These include all the bats in the eastern United States, and by the foreg ut precise diagonisis anyone can distinguish to which species a specimen The descriptions were taken from Prof. Jordan's new work upon of the United States.

Bats inhabit all portions of the world except the colder regions. There a nany species, which differ much from each other. Our own harmless when taken, bite furiously. They are very vindictive and difficult to t when once subdued form very pleasing pets, and feed upon flies and g is, as has been before stated, known that bats make no nest for their young any other way care for their offspring, except by carrying them hanging to ur, whether during flight or while suspended at rest by the legs. From the al we would infer that the young bats are born in an advanced condition, so as t able, as soon as possible, to take care of themselves, and that the number produ at a birth is small. Both these facts are true. The usual number of young only two, sometimes only one, while occasionally four to five are produced. one case a naturalist found that two unborn bats weighed two-thirds as muc the parent, and the average of twenty individuals gave the weight of the youn four-tenths that of the parents. The uniformity in the number of young produ at a birth with each species is very striking. Twenty-two of one species had two young, while forty of another had each one. In the former case the y were placed one on each side of the body, while in the latter case the single y was invariably found upon the right side of the body. Although bats usually h only two nipples, the American atalapha noveboracensis has an extra pair. of the most remarkable facts in connection with this subject is the power mother bats have to carry such a weight of young in addition to their own. A can carry nearly double its own weight. Another striking fact is the isolatio the females with young. In many caves and hollow trees where from twent one hundred females with young were found, either no males were found, or one or two. In one large hollow tree one hundred males were found and females. In another were found about an equal number of females, with on few males "here and there."—*Prof. B. G. Wilder.*

"To all this splendor of the western sky must be added the description o its fires as reflected upon the surface of the waters agitated by the trade wind the dark blue of the sea to the east, the white foam of the waves, which sharply defines upon this gloomy background the pale roseate arc of the eastern sky, and the sombre and greenish segment of the horizon."

"What spectacle can be more sublime than a sunset at sea," the fleecy cirro-cumuli clouds that nearly always accompany the setting sun, tinted with the myriad of charming, brilliant and changing colors, are reflected in the transparent bosom of the heaving sea, which seems a duplicate and gorgeous heaven below.

In North America the sunsets are particularly gorgeous. Often the entire heavens are dappled with clouds tinted with the most brilliant shades of gold. crimson, purple, green, and bronze, blendend and harmonized with an endless variety of the most exquisite shades and colors, add to all this the charming and magnificent spectale when the above gorgeous display in the heavens is reflected and duplicated in the tranquil bosom of a clear sheet of water, and the result is a scene of splendor seldom equalled upon this earth. To all this brilliant display is sometimes added broad bands of gold and crimson light, which, starting from the point where the setting sun disappeared, diverge and extend across the heavens in splendid and magnificent glory for 90°, or more frequently beyond the very zenith itself.

The light which accompanies or is the cause of twilight is occasioned by the reflection of the sun's rays, when below the horizon, from the vapors and minute solid particles floating in the atmosphere, "and perhaps from the material atoms of the air itself." It is to this property of reflection possessed by the atmosphere that its illumination is due beyond the direct reach of the rays proceeding from the sun, as under the shadow of clouds and behind opaque objects upon the surface, where, unless the light were directed upon some principle of general diffusion, intense darkness would prevail." "So also a sudden illumination would attend the rising of the sun, and instantaneous darkness accompany his setting."

"As the sun sets to any point upon the surface of the earth, the atmosphere above this point all around the horizon is illuminated by direct rays, and the reflection from so broad an illuminated surface brings down to the earth a large amount of light, but as the dark shadow of the earth, in consequence of the continued sinking of the sun rises higher and higher into the atmosphere at this locality, the reflected light steadily diminishes and finally disappears when no direct rays from the sun reach the higher regions of the atmosphere above the horizontal line extended toward the sunset." "By observing the time after the setting of the sun to the disappearance of the reflected rays, data are afforded upon which an approximate estimate may be made of the height of the atmosphere."

On the Equator the duration of twilight is one hour and twelve minutes, here the sun being upon the equinoctial, and apparently descends vertically, occu-

pying as much time below as above the horizon. "The variable length of light at the same place at different seasons of the year, results from the va declination of the sun and the consequent difference of time required to sink or 18° below the horizon, as its course is vertical or more or less approac it. Near the poles, where the sun attains at noon no great height abov horizon, it also keeps near it after disappearing at night; and if its depre does not exceed 18° the twilight is continuous into the dawn of the mor This is the case in some portion of the summer in all places for which the polar distance of the sun is only 18° greater than the latitude; and as this dist diminishes and the sun is less and less depressed below the horizon, the tw increases in brilliancy, and is finally lost during the period that the circuit o sun is above the horizon.—*Am. Encyclopedia.*

One of the most charming concomitants of the twilight hour in this cli s the evening anthem of the birds, which rings out in melodious notes from e ind tree, until the air is vocal with their lovely strains. To this is adde zephyrs or evening breezes that generally spring up at this hour, and hush and quiet of nature, render this one of the most enjoyable hou day in the country.

A curious fact is mentioned in Flammorins atmosphere in regard to the i nce of twilight upon the growth and construction of cities. Towns grow vestward direction, the tendency of population seems to be continual toward vest. "Paris, the cradle of which was the *Ile de la cite*, has, in its succe ggrandizements, constantly extended to the west. Two thousand years ago was situated on the northeast slope of Mount St. Genevieve, where the ar have recently been discovered. Under the Mesoringians it commenced descent toward the west, and has unceasingly progressed in that direction since. The wealthy classes have a pronounced tendency to emigrate westw leaving the eastern districts for the laboring populations.

This remark applies not only to Paris, but to most great cities, Lon Vienna, Berlin, St. Petersburg, Turin, Liege, Toulouse, Montpelier, Caen, even Pompeii; in this country to St. Louis, Boston, Chicago and many other

Whence arises this tendency? It can not be laid to the influence of ri upon which cities are built, which might be supposed to take their popul along with their current, for many streams flow in a contrary direction to tendency of the extension of the population, as the Thames, upon which Lon is built. Some have attempted to explain it by the direction of the wind, the wind tending to rise in the greatest degree the barometrical column, while west wind tends to lower it, and therefore inundates the eastern part of the t with smoke and deleterious cases.

Peahaps the love all people have, though all may not be able to exp it, or perhaps are not really cognizant themselves of possessing it, (yet we bel all human beings have more or less love for the beautiful in nature,) tends to d their faces to the west, there to view the splendors of a setting sun, and to c

The embryo bat resembles the ordinary small animal (mammal), the long fingers and persistence of the web between them, and its continuation from the border of the body and tail, are features of later appearance.

In conclusion we will say that bats bring forth their young alive and nurse them at the breast by milk; have red blood corpuscles containing no nucelous; are clothed with hair, and possess a corpus collosum, that is, a band of fibers connecting the two cerebral hemispheres. The ovum or egg is very small.

Bats are all included in the sub-order cheiroptera (handwinged). Bats are generally nocturnal animals, spending the day in caves and hollow trees. They are found in all portions of the world except the very coldest, but are most numerous and of the greatest size in the tropics. Those of the temperate regions of the globe generally spend the winter in a state of torpidity, in which, although circulation continues very languidly, respiration does not ordinarily take place. The bats of the temperate climates are all small, the largest British bat being only fifteen inches in stretch of wings, and its body not so large as a mouse. The United States bats are all of small size, the largest being only fourteen inches stretch of wing. But in the tropics bats are of great size, the kalong being five feet stretch of wing. Many bats have a peculiar leaf-like appendage attached to the nose, resembling a horseshoe. In others the ears are wonderfully large. Some of the species are gregarious; others are found only singly or in pairs.

TWILIGHT.

Twilight is that light that remains after the sun has set, or which is seen just before sunrise. The duration of twilight is, in many respects, an interesting and useful element to be acquainted with. It depends in a great measure upon the angle to which the sun has descended below the horizon, but it is modified by several circumstances, the chief among which is the degree of cleanness of the atmosphere. The direct light of the sun at the time of sunset reaches to the West; as the sun sinks its boundry line rises, and some little time afterwards crosses the Zenith, when civil twilight ends; the planets and large stars then become visible to the naked eye. The eastern half of the sky being thus first deprived of direct solar light, night begins there. Afterward, the boundry line (the crepuscular curve) itself disappears in the west; then the astronomical twilight ceases and night has fully set in. Twilight begins or ends when the sun is at a certain distance below the horizon; this distance is variable, depending upon the state of the atmosphere. It may be taken that civil twilight ends when the sun is about 8° below the horizon, and that astronomical twilight ends when the sun is 18° below the horizon. The phenomena of twilight are hardly kuown in tropical climates; as soon as the sun has descended below the horizon darkness sets in suddenly. This was remarked by Bruce at Sengal, where, however, the air is

so transparent that Venus may sometimes be distinguished at midday, and in interior of Africa night succeeds day almost immediately after sunset. Cumna, Humboldt tells us, twilight lasts but a very few minutes, although atmosphere is higher under the tropics than in other regions.

In warm countries the presence of humidity in the air not only gives to sky the dark azure tint, but also has the effect of modifying the vital powe the solar rays. At the Equator it adds to the thousand other wonders of n an incomparably beautiful display of light both at sunrise and sunset. The set, in particular, affords a spectacle indescribably magnificent—a superiority sunrise attributable to the presence of moisture in the air. This is more ab unt in the evening, after the heat of the day, than in the morning, when it is ially condensed into dew by the effect of the cooler temperature of night."

"One of the greatest charms of twilight is the varied and endless gorg of the clouds, which accompanies the setting of the sun. But it is n our climate that the finest sunsets are seen. The celestial blue of distant m ains, the rose or violet tints which in turn tinge the nearer hills, and the w ones of the soil, harmonize in a marvellous manner, when the sun disappear ow the horizon, with the gleaning gold of the West, the red," purple, gold roseate tints that dapple each cloud, or "that crown it in the sky, the dark a of the Zenith, and the more sombre and often, in contrast to the others, gre nue which prevails in the east. In the equinoctial regions these soft and del tints, joined to the varied aspect of the earth's configuration and the richnes vegetation, produce more striking "and gorgeous" effects than with us. S times light and roseate clouds, fringed with a coppery red, produce pec effects, similar to certain sunsets in our regions; but whenever the sk clear the shades differ entirely from those of the temperate zone, and prese special character. Sometimes, too, the indentations of mountains situated low the horizon, or invisible clouds intercepting a part of the solar rays wi after sunset, still reach the elevated regions of the atmosphere, give rise to curious phenomena of crepuscular rays.

"Then may be seen, starting from the point where the sun has disappe a series of rays, or rather of diverging" "glories," "which sometimes exte far as 90°, and even in some instances are prolonged as far as the point opp the sun. Upon the ocean, as M. Liais remarks, where the sky near the equ is free from clouds in the visible part, and when the diverging rays mingle the crepuscular arcs, the play of light assumes a form and brilliance which all description or pictorial illustration. How, indeed, is it possible to depict pletely the rosy tints of the arc fringed by the crepuscular rays that border segment which is still strongly lighted up from the west, the segment itself l tinged with a bright gold hue? How, above all, is it possible to describe the of an inimitable blue, different from that of noonday, and occupying that po of the sky which is included between the ordinary azure and the crepuscular arc

* Flammarions atmosphere.

Blood stains examined after a fall in 1870 gave clay, chalky sand, peroxide of hydrate of iron, nitrogenised sodium, silica and organic matter. This was traced to its origin, the Sahara Desert, in Africa, from whence the wind was blowing. All the above facts prove that the so called showers of blood are a reality, and that they are mostly due to dust taken up by the wind and carried to very distant regions, and that they are not unfrequent.

Another cause is the ashes from volcanoes which are sometimes carried to immense distances.

Another series of remarkable showers are noticed in ancient legends, exaggerated and interpeted in various ways.

Showers of milk are spoken of as having taken place. Thus, in 620, streams of milk are said to have flowed into a Roman lake. Obsequens relates that a shower of milk and oil fell upon Veies in 629. These so called milk streams are common occurrences in many districts, and are occasioned by the flow of water over a white soil, or the washing of rain upon such soils. The fall of ashes of a volcano or the carrying into the air of white or chalky earth by hurricanes, will also account for the supposed showers of milk.

Many authenic accounts are given of the appearance of crosses upon men's clothing. In 764 the misbehavior of the monks of St. Martin drew down the anger of God, blood fell from the heavens on the earth, and crosses appeared upon men's garments.—*Grigory of Tours.* In 1094 crosses fell from the sky upon the garments of men. The same thing happened in 1534 in Sweeden.

The true cause of these crosses may be found in dust, which being lifted and carried by currents of air, mixes with the rain, and leaves its stain upon the garments, but why in shape of a cross is not ascertained, for it covered not only the clothes, but walls and other substances.

Showers of leaves, pollen, flowers and fruit, lifted and carried by the wind are frequent and well authenticated.

The fall from the sky of frogs, fish and grain is also well authenticated and not uncommon. In 1828 an abundant shower of an edible lichen fell in Persia covering the ground to the depth of five or six inches; the cattle eagerly ate of it. Grains like wheat fell from the sky in abundant showers throughout Carinthia from which bread was made.

Showers of sulphur have fallen in several places, probably arising from volcanoes. In May, 1646, there was such a fall in Copenhagen which inundated the whole city.

Great showers of locusts, beetles and grasshoppers, so immense as to darken the sky and cover vast tracts of country, fall upon the land in various districts.

In the town of Virtud, in the southern part of the department of Choluteca, Honduras, is a cave, from the roof of which issues a stream of fluid resembling blood: it drops steadily on the floor of the cave, forming pools of coagulated matter, and tinging with a red color a brook which flows by the cavern. This fluid has not only the color, but the taste of blood and when exposed to the air a

short time, it corrupts and emits an offensive ordor. This singular stream ably owes its peculiar properties to the presence of innumberable quantiti minute infusoria.

Thus it is seen that the power of the wind is sufficient to lift and car great distances large bodies. Through its agency are accounted for all the gular phenomena of the atmosphere, which once were given a supernatural c

HAIL.

Hail is the watery vapor of the atmosphere, congealed in icy masses, anc cipitated upon the earth. It usually falls in the warmest part of the day, a most frequent in spring and summer. It is formed like rain, from the w vapor of the atmosphere, but amidst an atmospheric cold which freezes the glo of water at the very moment of their formation. To effect this phenomen lower strata of air must be very hot, while the upper currents of the atmos must be intensely cold. The following is the usual process of its formation :

Hail occurs during a thunder storm, when the temperature is very high the surface of the ground, but decreases rapidly with elevation, and this decrease is one of the principal elements in the formation of hail, and is oft much as one degree to one hundred feet of ascent. Clouds situated 10,00c or more above the earth contain ice at from 22° to 40° Fahr. The lower c contain vesicular water above 32°. As a rule, these clouds travel in dif dicections, and hail is formed when there is a collision and admixture of that are opposed to currents and clouds, the temperatures of which are diff The vapor, which then resolves into rain, freezes instantaneously in so temperature. Carried off by the wind, and even exposed to the influence of site electricities of the diverse strata of cloud, these frozen drops do not f once, notwithstanding their weight, and they have time to become enlarg the addition of a considerable quantity of water, which they collect during passage through the air.

The extreme cold that prevails in the clouds below the region of per snow is due, in a great measure, to evaporation, which has itself a double ori the action of the sun and electricity, it having been noticed that after every tric discharge the rain or hail falls in great quantities, and the re-action pro a dilation which gives rise to rapid evaporation. The formation of hail-stone very rapid process.

The surface of hail clouds often presents here and there great and irre protuberances. Seen from underneath, they are generally dark in color their density and opakeness, through which the rays of the sun cannot pene They are distinguished from other storm clouds by their dark ashen hue.

edges are indented, but they are soon lost in the general mass of the nimbus or rain clouds.

The destruction to property occasioned by hail-stones is frequently very great. In the storm that visited France in July, 1788, no less than 1,039 communes were devastated, and the damage was estimated at not less than $5,000,000. Crops were cut to pieces, and the smaller animals killed. Some of the stones weighed 3,900 grains, or more than half a pound. They were of various shapes, some spherical, others long and pointed, and some pyramidical. This storm traveled at the rate of thirty-two miles an hour. The hail fell for not more than seven or eight minutes in the same locality. In the storm that occurred in France in May, 1865, the hail-stones covered the ground with a thick layer twenty leagues wide. The hail-stones did not melt for four days.

In a fall of hail in 1852 (France) the stones were as large as hens' eggs. The crops were cut to pieces, trees entirely stripped of their leaves, cattle, sheep and pigs severely injured, windows broken, and the whole district deprived of game, many of the smaller animals were killed outright, even the wolves were found dead in the woods. In some sandy places hollows were found as if made by cannon balls, occasioned by the force of impact of the hail-stones.

These are exceptional cases. In most instances the fall of hail is not accompanied by such disastrous results. Although hail storms are accompanied by the development of vast amounts of electricity, and the hail cloud is loaded with vast amounts of the electric fluid, which is continually developed, yet the greater portion is exhausted within the various layers of the clouds themselves, or in reciprocal discharges with neighboring clouds. For this reason the flashes of lightning are generally very faint or altogether imperceptible. There is often a continuous roll of thunder and no visible lightning, either because the flash is very small or takes place entirely within the interior of the clouds.

In May, 1865, hail fell in France, covering the ground with a layer of stones five yards deep, which did not disappear for five days. In some places this immense fall filled up the water courses, forming a solid, compact mass, which acted as a dam or dike to keep the water back, while the ground was covered to the depth of two and a half feet with the hail-stones.

It may be interesting to know the greatest size hail-stones attain. The usual size is from 46 to 120 grains, or from one-fourth of an inch to one inch in diameter. Stones two ounces in weight are not uncommon. Well authenticated instances are on record of hail-stones of from 1,400 grains to 3,900 grains in weight. Stones of from three to four inches in diameter frequently fall, while those as large as turkey's eggs are not abnormal. In the fall of hail May 4, 1697, in Flintshire, hail-stones eleven and three-fourths inches in circumference fell. In 1832, during a hail storm in Spain, stones of four and one-fifth pounds weight fell in great numbers. Roofs were crushed in, men crushed to the earth, and cattle killed. In 1798, stones fell in Germany from one-half inch in diameter to the weight of eight pounds. In the storm at Tussi of July 24, 1832, stones fell of one and one-half

pounds. One weighing fourteen pounds was examined, and another large stone crushed through the roof of a house. Instances of hail-stones of twelv fourteen pounds' weight are not uncommon. In a hail storm at Jackson, La., stones as large as walnuts fell in showers, pouring down in torrents and cov the ground many inches deep. Great numbers of cattle were killed. In storm of 1801 at Mannorical bay, Asia Minor, hail-stones covered the ground feet deep.

The shape of hail-stones varies considerably, but the usual form is a spl often more or less roughened upon the surface by irregular protuberances. ure sometimes elongated, flat or pyramidical in shape. One examined by De was a regular sphere, composed of several concentric strata around a dense sp cal neucleus, opaque and whitish. Around this neucleus was an envelope of pact ice, radiated from the center to the circumference. and terminating upon exterior in twelve large pyramids. Between were intercalated smaller pyra whole formed a spherical mass three and one-half inches in diameter.

In 1863 exhibited a neucleus, surrounded by a mass of ice. The tedric tissue, examined through a glass, had the aspect of a series of six poi pyramids, and a section of the interior exhibited the existence of a hexagonal work of meshes. Hail-stones, when opened, generally present an outer h geneous coating of opaque ice, or a succession of alternate layers of opaque transparent ice enclosing a central neucleus of spongy but hardened snow. S times they contain, inclosed within their substance, foreign substances, suc ashes, straw, sand, or bits of leaves.

Hail usually falls in summer, and generally in the afternoon, when the ditions most appropriate for its formation are prevalent, viz., great heat near surface of the earth, which diminishes rapidly with increase of elevation, and w is accompanied by a considerable evaporation from the clouds under the acti the sun; as, however, the mere collision of a very cold upper wind with a warm wind, at the same altitude, may produce hail. It occasionally falls at r or even in midwinter, but this is of rare occurrence.

The velocity of the fall of hail-stones is usually not so great as one w expect from their density, and many theories have been advanced to account the comparatively slow motion—as the resistance occasioned by upward curr of air—or the retardation occasioned by the neucleus continually taking up in descent accessions of vapor, which are in a state of rest. But their descent is always slow. In a storm in India, in 1931, hail-stones ploughed up a gravel like musket balls, passing through glass windows, making smooth, round h without cracking the glass. Hail storms are almost unknown in the polar regi and are more frequent in the temperate than in the tropical regions. Some tricts are more subject to them than others. The south of France seems par larly liable to them, where, as well as in Germany, tall poles called hail rods erected to attract and draw off the electricity which is developed in the hail clo and thus disarming the clouds, supposing that hail, like lightning, is the resu electricity.

As a general rule hail storms occur at the close of long periods of calm, hot and sultry weather. They are immediately preceded by a fall of the barometer, and what is unusual before rain, a corresponding fall of the thermometer. The thermometer, during a hail storm, has been known to sink through 77° Fahr. As a rule, hail clouds are not so high as rain clouds, while the area of hail storms frequently extends over great distances in a linear direction. Its breadth is seldom very great. Its motion is rapid, often forty miles an hour. A peculiar rustling sound in the air often precedes the fall of hail. This is accompanied by a darkness similar to a total eclipse of the sun. Hail storms are seldom of long duration. From three or four minutes to a quarter of an hour is the usual limit.

SOME FACTS IN RELATION TO THE HABITS OF THE ROUGH-WINGED SWALLOW.

(*Hirundo Serripennis.*)

In the June number of the SCIENTIFIC MONTHLY a description of this bird, together with a very good life-size plate of the male, was given. Since the appearance of the above plate and description, a very good account of its breeding habits appeared in the "Bulletin of the Nuttall Ornithological Club," by Walter Van Fleet, from which we make the following extract, as it throws some light upon the habits of this comparatively little known and obscure species. Mr. Van Fleet says:

I have, during two years of rather careful observation, noticed a constant and decided difference in the breeding and other habits of the rough-winged swallow, as compared with the bank swallow (*H. riparia*). The main points are as follows:

H. serripennis is not gregarious while nesting, but during the breeding season appears rather to avoid its kind, as well as the bank swallows, and to associate only in pairs. Their nesting holes are not placed near each other in the manner of *H. riparia*, but are scattered along the banks of creeks and rivers at irregular intervals, wherever an especially favorable locality occurs. They very seldom excavate a hole for themselves, but generally take up with any suitable cavity, and alter it to suit their taste. It is quite common to find them breeding in deserted kingfishers' holes, and in this case placing the nest within a foot or eighteen inches from the entrance. They will also, on finding a decayed root of sufficient size, leading in from their favorite sand banks, remove the soft punky wood, following the winding of the root, until they have arrived at a suitable distance—about two feet—where, after enlarging the cavity, they place their nest. This species is also fond of building in holes in stone bridge piers and other masonry, near water, returning to the same place year after year.

In the few cases which I have observed of their excavating for themselves, it has been done in a very slovenly manner, and invariably their holes have been much larger than is apparently necessary, and round at the entrance, while on the

contrary the holes of the *H. riparia* are very symmetrical ellipses, with the l axis horizontal, and not larger than is needful to permit free ingress and egr the birds. I have never yet, in this locality, found a Bank Swallow's hole enough to admit the hand, without enlarging, while the nest of the Rough- can generally be reached without any trouble, except when built in masonry. this case they will pass through a crevice barely large enough to admit bodies, providing there is a cavity within large enough to contain the nest.

The nests of *H. serripennis* are *generally* much more carelessly built than of *H. riparia;* thay do not seem to go any distance for their materials, but a to pick up anything suitable which they can find within a few rods of their tation. The nests of the two species are composed of nearly the same substa but those of *H. riparia* exhibit a greater variety in the same nests, for, as build in large colonies, they are obliged to search for materials in different p On one occasion I remember finding a nest of *H. serripennis* composed entir feathers of domestic fowls. It was built in a deserted Kingfisher's hole, in a bank, about fifteen rods from a barn-yard, in which fowls were constantly At another time I found three fresh eggs lying on the bare sand; the hole v mere pocket, barely six inches deep. In this case the female bird was pro under so great a necessity that she did not have time to construct a nest i usual manner, but had hastily deepened the already found cavity.

I have quite frequently found fresh eggs in the nests of *H. serripennis* those far advanced in incubation; indeed, have found fresh, nearly hatched and young birds, in the same nest, but I have never noticed anything lik among Bank Swallows, though I have searched carefully.

In general habits the difference is perhaps less marked. The Rough- arrive here about the 10th of April, in large numbers, full two weeks befor Bank Swallows, and are found in company with *H. horreorum* and *H. l* playing around, and chasing insects over the ponds and rivers.

About the first of May the Bank Swallows come; *H. Serripennis* then ap to grow scarcer, and to desert the vicinity of ponds and streams where ther no sand banks. During the latter part of June and through July, I have met pairs of Rough-winged swallows flying steadily in a particular direction or another turning out to pursue an occasional insect, but when it was cap returning to its former general course, over meadows, forest and streams unti to sight. I have thus met pairs at different times, going towards all points o compass. As they fly quite high at these times, I have never succeeded in k both birds, but think they would prove to be male and female.

About the last of August, both this species, and *H. riparia* begin to mi southward, associated with the Barn Swallows; when there is no perceptibl ference in the habits of either. By the middle of September they have all d peared.

THE RAVAGES OF OLD OCEAN.

BY J. MANFORD KERR.

Constant and unintermittent change in all things, is the order of the universe. Nothing is stable. Nothing is durable. The seasons constantly come and go; Summer succeeds to Spring, Winter to Autumn, and each is accompanied by marked peculiarities which apprize us of unabating change. In the Spring herbs spring, trees bud, and flowers bloom; the sultry Summer beholds fully displayed the rich magnificence of vernal nature, and the dwellers *in pair* luxuriate in a terrestrial paradise of beautiful flowers, delicious aromas, and enchanting coral-lings; yellow Autumn's chilling frosts destroy the beauties and ripen the fruits of Summer, while succeeding Winter from his hoary locks shakes snow and desolation o'er all nature, locks her productive powers in icy fetters, and all animation in dreary solitude.

The children of men are born into the world, and after an ephemeral sojourn, pass beneath Lethe's wave, like the verdant grass or blushing flower they heedlessly tread beneath their feet. The wall-flower, the violet and the jasmine—creatures of delicacy, tenderness and beauty—endure but for a season. The giant forester attains the acme of its glory, grandeur and vegetable supremacy, after many years of exogenous accreation, and then gradually returns to the elements from which it was built. In man even the bony structure, the muscular substance and the adipose tissue are entirely changed every seven years. All that has animation perishes and passes away. Men are accustomed to look upon the rocks on which they tread as eternal, impregnable by time or the restless elements; and with them the majestic mountains, which, towering aloft, protrude their bleak summits into the inhospitable region of the ethereal blue, which lies beyond the floating clouds, are the emblems of strength and durability. But their adamantine rocks are slowly but constantly disintegrating, and little by little disappearing. The theater where the griffins and monsters of the ancients battled and disported, and the throne from whence the renowned thunderer dispensed the harmony of heaven and decred the fate of mundane creatures, are gradually succumbing to the arm of the mighty Zeus, who will, like the wide-renowned Alexander of old, extend his conquests over the whole known world, and having dethroned the rival potentate of earth, the empire of Neptune will extend throughout the length and breadth of the globe.

The conquest of which we speak is now in progress. The din of the contest may be heard in all quarters. The herald of the strife is the incessant mutation of which we have spoken. The forces of the aggressive monarch are invincible, and its ultimate triumph is simply a question of time. No palladium can shield from the deadly shafts of the enemy; no citadel can withstand his progress. One by one the smaller towns have been besieged and the inferior fortifications invested, all of which, after a brief though soldierly defense, have yielded to superior

forces and inevitable fate; and now the Gibraltar of the invaded empire is l
Already the outer works are won, the fosse is crossed, and under the steady
manic stroke of a foe, confident of success, and not over anxious for the redu
of the fortress, or impatient for the spoils of the conquest, the wall trembles

"To its fall leaning awful."

The forces employed for the reduction are the irresistable forces of nature
self—oceans, rains, frosts, swollen-streams, and mountain torrents—whic
continue with ambition unabated and vigor unimpaired, until the completi
the conquest shall proclaim them invincible; and then, because of the want
other world to conquer, will be consumed by a lapse into physical stagnation

What has already been accomplished—the position gained by the en
forces—is cognizable to the alert eye of the intrepid, but fated commander
beleagured braves. What yet remains to be accomplished, is but too clearly
ceptible to the discerning.

What is the nature and extent of the work yet to be accomplished, to
plete the reduction, we will see.

There was a time, if *time* it may be called, when the earth and the ocean
rocks and the mountains, did not exist. All was chaos and confusion.
was neither form nor symmetry, law nor motion. Out of this formless and
less chaos and stagnant confusion the power of omnipotence struck "form
beauty rejoicing in life;" erected the world and all the brilliant orbs of s
Let us withdraw our considerations from the countless orbs of the boun
realms of space, and confine our attention to

"This gravelly ball, the mundane sphere."

In the early history of our planet two great powers were predominant.
contended with inveterate resolution for the domination of empire. They
pent-up igneous powers, and unconfined aqueous forces. To the freaks of
operations are to be attributed all the phenomena of inanimate existence, as
as the diversity of the physicial appearance of the earth and the ocean.

Primarily the igneous forces—the powers of internal heat—were pre
nant, and successfully repelled their aqueous rival. But as time wore o
dominant, confident of superiority, grew less alert and more restive, th
permitting the eternal vigilance of his untiring antagonist to obtain a secure
hold within the disputed domain. The conflict was now a strife for empi
death struggle. The igneous forces, in the vigor of youth, strength and
ity, gained a partial victory, and the mountains, continents and islands
triumphant over the sea,—the guerdons of prowess and the trophies of tri
Old Ocean though defeated, was not conquered. He consented to a truce
he might re-assemble his scattered forces, and renew the contest. He swore
nal enmity, and, Dane-like making murderous incursions and foraging foray
the border land whenever opportunity affords, he has ever since ranged rest
round the world, gnawing the face of the beetling cliff, lashing the coasts, le
upon and furrowing into fiords the land. He impressed the rivers and
"and right faithfully do they forage to supply the cravings of his insatiate m

The incessant ravages of ages have not only changed entirely the coasts, but actually demolished the primitive rocks; ground them to powder and scattered them as sediment over the bed of the ocean, thousands of feet in thickness. The *debris* thus scattered over the floor of the ocean, would be arranged in layers; the heavier materials would necessarially be carried a less distance than those of less weight, with the same transporting power. Everywhere we find this water-pulverized and stratified rock resting upon the primitive granite envelope. The Laurentian system is the lowest strata of this class of rocks, and in Canada has an average thickness of from 30,000 to 40,000 feet.

Every storm that lashes into fury the waves of ocean, adds to the savageness of its ravages. Every purling stream that trickles from a mountain summit transports earth and rock *detritus* to the plain below. Every rain that falls swells each mountain torrent and increases its fury, abrades every hill, and adds to the alluvial of the plain.

The Apalachian range once thrust its multiple peaks into the inhospitable regions of which the Himalaya and Andes are the stern and solitary occupants, but have been chiseled down to third-rate elevations. The materials pealed from their bleak bold crests have been washed into the valleys at their foot, or transported to the border of old ocean, and, gradually encroaching upon his dominion, formed the basis of the Atlantic States.

The Alleghanies, in the vigor of youthful manhood, towered 3,000 feet higher than human eye has ever beheld them. The pearings of their denuded summits have been strown over the bottom of the Gulf of Mexico and sunk in the Atlantic Ocean.

The Catskill Mountains are the "bench-mark of the elevation of an elevated plateau which extended from their site to Massachusetts Bay. The fertile and salubrious basin occupied by the whole of middle Tennessee, was formerly covered by the Cumberland Table-land, which extended over 150 miles farther westward than its present limit. This table-land and the abrupt elevation in the vicinity of Chattanooga are outlines in relief indicating the extent and elevation of the vast plateau which has been planed down and scooped out by the tremendous denuding powers of nature; the materials have been applied to the formation of that region of country which has since been erected into the States of Georgia, Alabama, and Mississippi.

But all these are insignificant when compared with the enormous excavation wrought by the Colorado. This patriarchal stream takes its course through an elevated plateau hundreds of miles in extent—traverses the great American Desert. Shrunken and shriveled—palsied by age, but still potent to carry on the work of destruction on a less magnificant scale—it now meanders a silver thread in the region of dim twilight thousands of feet beneath the level at which it once ran, and over that "defiant granite, which buffeted the lightnings that rent Sinai, and frowned upon the flood that drowned the world."

The leveling process is not yet arrested. The thunder-voiced Niagara, over which Nature has placed her eternal iridescence, has been toiling for countless

ages, but is still in the vigor of strength and potent for destruction. After t for ages his works were entirely detroyed by the obliterating influence of a nental glacier. After the æon of ice and gelidity was past, like Newton whe laborious calculations of years were destroyed by his dog "Diamond" ups a lighted taper on his desk, Thomas Carlyle, when the first volume of his H of the French Revolution was destroyed by the reckless servant of a careless f to whom he had loaned the MS. for perusal, or Robert Ainsworth, after th uminous dictionary of the Latin language, upon which he spent many ye hard labor, was thrown into the fire by his vixen wife,—the invincible and fatiguable destroyer sat cheerfully to work, and what has since been accompl is the wonder of the world.

The mighty Mississippi, as it rolls on towards the Great Ocean, bears w sediments constituting "a whole museum of soils, gathered from the fertile of New York and Pennsylvania—from the sandy cliffs of the great Kenaw from the clayey slopes of Cincinnati—from the slimy borders of Lake Pe from the melon-patch of a Cheyenne squaw, and from the beetling cliffs Yellowstone." The formerly formidable Colorado, now but a mere wreck of it once was, still prowls around the base of the towering cliffs which rise ab like a restless hyena around a burial cave, and chafing against the adam walls which hem it in like a lion against the iron bars which confine him. A eral branches and smaller streams have aped the action of the lager ones, a contribute the sum of their physical strength—no insignificant force when u for one purpose and directed against one object—to complete the leveling earth—to consumate the reduction of the empire of earth.

The ultimate triumph of old Ocean is inevitable; but his reign will short duration. The gradual withdrawal—dying out of the firey forces of adds basic strength to the powers of the present overpowered but not vanqu earth. This withdrawal will permit the forces of refrigeration to be brou the succor of the besieged; and after a long and bitter conflict—long afte sons of man shall have passed from the stage of life, and the curtain shall dropped upon the last scene of terrestrial animation—the thirsty rocks, bu with long-settled hatred, will devour with cormorant avidity their life-long e and Neptune, the rival potentate, will be left to famish upon the strand.— "*Destiny of the Ocean*," Feb. SCIENTIFIC MONTHLY, page 221.]

OZONE.

BY PROF. R. C. KEDZIE, PRESIDENT OF THE MICHIGAN STATE MEDICAL SOCIE

Of all the agencies which act on the human frame during its entire hi no one is so persistent and continuous in its influence as air. The breath an life, march with locked step from birth to death. While the atmosphere is

unintermittent in its action than any other physical or chemical agency, it is also capable of wider variation in its composition and properties than the other agencies which effect the well-being of the human frame. In our consideration of the various agencies which influence health and disease, we have given too little prominence to the variations in the composition and properties of this pervasive and primal condition of animal life. Some attention has been called to the change in its properties by local contamination, by respiration, the want of ventilation, and the influence of exhalations from decomposing organic matter. I would not undervalue the importance of the results thus obtained. But the atmosphere needs to be studied, not alone in its restricted changes in dwellings, but in the significant changes which are found in the great mass of the atmosphere, which is not enclosed by roof and walls, not bounded by city limits and corporation lines. The air which fills "all out-doors" should be studied even more carefully than the air found "in-doors." The regional and seasonal changes in its composition and physicial properties, and the relations of these changes to health and disease, demand a careful and patient investigation at the hands of the medical profession.

Something has already been accomplished in this direction. The attention of the profession has been called to the possible connection of consumption, pneumonia, croup, etc., with varying amounts of atmospheric moisture. Much more remains to be done in regard to the special influence of these variations, and the relation of all epidemic and endemic diseases to variations in atmospheric humidity, demands careful consideration at our hands.

Atmospheric change, as related to health and disease, is a wide field for investigation and study, and a field which gives promise of rich harvests in the future. I do not propose to take up so vast a subject for the consideration at this time, but confine myself to a brief cosideration of one of the most variable, but most energetic of the constituents of the atmosphere, viz.: Ozone.

I call it the most variable of the constituents of the atmosphere, because, while its absolute amount is never large (1 part by weight in 450,000 of air is its maximum according to Houzeau), yet it is often found to be entirely wanting. Not so with the other constituents of the atmosphere. Air is never found under natural conditions absolutely deprived of moisture: the variation in the amount of carbonic acid in air under natural conditions is confined within a very narrow range: the variation in the amount of oxygen under natural conditions is very small, and when we compare ordinary oxygen with ozone in regard to their chemical activities, the variation in the amount of oxygen, as compared with ozone, becomes infinitessimal.

I call ozone the most energetic of the constituents of the atmosphere, because Houzeau has found that it has forty times the bleaching power of chlorine. Compared with the normal constituents of air, it is an agent of amazing power. Such a substance present in the air which bathes our bodies at all times, and which penetrates our lungs with every breath, must be, for good or ill, a force of singular power over the human frame. Its presence or absence in the atmosphere must have a controlling influence over the vital powers.

HISTORY OF OZONE.

It had long been observed that air surrounding a highly charged, prime ductor, had a peculiar odor, called the "electrical odor," the same that is perc after a stroke of lightning. In 1785 Von Marum, of Holland, observed oxygen gas through which eletrical sparks had been passed acquired a peculiar and the property of attacking mercury. The odor was attributed to particl finely divided metallic oxide diffused through the gas. The subject receiv further attention till 1840, when Schonbein, in a communication to the Aca of Munich, announced that in the voltaic decomposition of water, an od substance accompanied the oxygen evolved at the positive pole of the bat that this odorous substance could be preserved for some time in well-closed ve Schonbein supposed it was a new elementary body, and on account of its pe odor gave it the name of ozone. He next supposed that ozone, combined hydrogen, would form nitrogen. He next concluded it was a terxoide of hydr In 1858 he finally concluded that ozone is negatively electrified oxygen, positively electrified oxygen he called antozone. This antozone has since shown to be the binoxide of hydrogen of Thenard. Schonbein also disco that ozone is formed whenever moist air streams over phosphorus. To Schon therefore, belongs the honor of discovering ozone as a separate form of m identical from whatever source derived, and of demonstrating most c properties.

In 1845, Marignac and De La Rive showed that the influence of ozon simply *oxidizing*, and they called it an allotropic form of oxygen, and Ber adopted the same view.

In 1856, Andrews demonstrated that ozone was identical, whatever the s from which it was derived. In 1860, he showed that ozone was more dense ordinary oxygen; a volume of oxygen gas was then ozonized, contracting in v to the extent of eight per cent. in some instances.

In 1861, Dr. Odling suggested that the molecular formula of ozone wa the molecule of passive oxygen being O_2, or that ozone was an oxide of ox In 1865, Soret confirmed this view by showing that while iodide of pota and mercury would only remove the third atom of oxygen in ozone, the spi turpentine would remove the whole molecule: *i. e.*, while KI would remov eight per. cent. of oxygen caused by electrifying oxygen gas and leave the m two per cent. of ordinary oxygen, spirits of turpentine would remove the molecule of ozone, and leave only seventy-six per cent. of oxygen in the p form.

In 1872, Sir Benj. Brodie, by a very careful examination of very l ozonized oxygen by means of hyposulphite of sodium, spirits of turpentin stannous chloride, has confirmed the hypothesis of Dr. Odling, viz.: tha formula of ozone is O_3, and that three volumes of oxygen are condensed int volumes of ozone, and that the density of ozone is one-half greater than th passive oxygen.

METHODS OF FORMING OZONE.

Ozone may be formed by the decomposition of water, or by any chemical reaction by which oxygen is liberated in the free state. Oxygen liberated by decomposing chlorate of potassium by heat, always contains a trace of ozone. Oxygen formed by acting on black oxide of manganese or peroxide of lead by sulphuric acid, always contains sensible quantities of ozone. A very ready way of forming ozone in small amount, but continuously, is by action of concentrated sulphuric acid on the permanganate. Such a mixture placed in a glass bottle and closed with a glass stopple, will evolve ozone for weeks and some times for months. Indeed, a bottle which I thus prepared more than a year ago, still evolves very sensibe quantities of ozone.

Ozone may be formed in large amount by electrifying air or common oxygen. It is by this process that ozone is usually made when required in large amount, or in very concentrated form.

Ozone is also formed in all the ordinary forms of oxidation. Thus every flame produces (and destroys) a large amount of ozone. Where there is oxidation without a very high temperature, which destroys ozone, this substance is produced in comparatively large amount. A very elegant form of producing ozone is to plunge a glass rod heated to 300° or 400° Fah. into a mixture of vapor of ether and air. This method was once supposed to be anomalous, but I find that it comes under the general law, for if the heated glass rod be plunged into the mixture in the dark, a beautiful greenish-blue lambent flame envelopes the rod, and if the temperature is too low to secure this result, no ozone is formed.

I also find that ozone is instantly formed when ether is dropped on platinum black. I prepared some platinum black and threw it on a filter: when dry, I placed the glass funnel, holding the filter, over a tall glass vessel containing a slip of test paper: I placed a test paper in the upper part of the funnel, poured a little ether on the platinum black, and instantly covered the funnel with a large watch-glass. Both test papers were at once turned purple from action of the ozone. On raising the glass cover, the filter paper in contact with the platinum black took fire spontaneously and burned up.

Prof. Bettzer has succeeded in igniting a jet of coal gas as it escaped from a glass tube, by causing it to come in contact with ozone evolved by the action of strong sulphuric acid on permanganate of potash.

A very ready way of forming ozone in small amount, but constantly, is by means of the flameless lamp, viz: by placing a coil of platinum wire in the wick of an alcohol lamp, lighting the lamp and letting it burn till the coil is red hot, and then suddenly extinguishing the flame, when the coil of wire will glow with a flameless combustion for hours, and sometimes for days. By this means a sick-chamber may be charged with ozone in small amount, but continously. If the alcohol contains some essential oil, the ozone is given off still more abundantly.

Another agency by which ozone is formed is sunlight. It is my conviction that when sunlight falls upon any moist and oxidable body in the presence of free

oxygen, ozone is formed. It is often objected that the Schonbein test pa unreliable for detecting ozone, because sunlight will color it the same as c The suspicion arose in my mind that this reaction was due to ozone generat the sunlight. To test this matter I placed this test paper, freed from every of free oxygen, in carbonic acid, in hydrogen and in nitrogen gas, and left posed to the sunlight for days at a time, but no discoloration took place. I placed it between plates of glass, and excluded air by paraffin, and expos paper so guarded to sunlight for several weeks, produced no change; but on turing the upper glass and leaving it similarly exposed, a change of color be once at the line of fracture, and extended to other portions of the paper. In manner I placed the test paper in perfectly dry air in a flask and hung it i sunshine for many days, but no change took place, although a slip of test suspended in another flask containing a few drops of water, and suspended l side of the first flask, was deeply colored in a few hours. These facts lea to believe that sunlight acts upon Schonbein test paper solely by producing itself. The production of ozone by sunlight will explain the old method of bl ing linen and cotton cloth by exposing it to sunshine in a moist state. Oz nature's great bleaching agent. It attacks and destroys all organic colors. formation of this active color-destroyer explains why the housewife so car shuts out the sunlight from her rooms, lest carpets and furniture should fe whitening touch.

The color of the light has a marked influence on its ozonizing power. light is the most powerful, then the blue rays, and as we proceed to the red e the spectrum the diminution is very rapid. From the few experiments I been able to perform, I find that if we represent the ozonizing power of white as ten, the blue rays will be six, the green two, orange one, and red none will be remembered that the chemical rays of the spectrum diminish in the direction, and nearly in the same proportion. These facts may be found to more than an accidental relation to each other.

SUNSHINE AND HEALTH.

The important relations which sunshine bears to health have long been r nized, and we seem to have accepted this as an *ultimate* fact. But *why* is it ficial? May it not yet be found that our explanation of the beneficial influe sunshine on animal life is its power of generating ozone? A sunny room sunny side of the house is everywhere recognized as more healthful than a room or the shady side of the house. These dark chambers are the hom scrofula and anæmia. The unhealthfulness of such dark rooms does not ne rily arise from any deficiency of oxygen, excess of dampness, want of ventila etc., though any or all of these causes may add their baleful influence; but potent factor of disease is the absence of sunshine itself. I raise the query wh this absence of sunshine is not injurious mainly from the fact that no ozo generated in such sunless reoms? It is not a sufficient reply that ozone is al

never fonnd in inhabited rooms. Ozone is destroyed as fast as formed wher putrescible matter is psesent to be oxidized. The ozone that we find at any tim is only the residual ozone which has not been destroyed by decomposing organi matter. Ozone is doubtless formed in every sunlit room, and by its formation an destruction a vast amount of *materies morbi* may be destroyed; and it is no satisfac tory proof that it is of no worth or influence because no residual ozone remains t act upon our test paper.

WHERE FOUND.

Ozone is formed everywhere in the air that rests upon the earth's surface. I is found wherever the agents which cause its destruction are not present in suff cient amount to cause its entire removal. The ozone found in the air is alway the difference between the amount formed and the portion destroyed. The amou of this residual ozone varies greatly in different parts of the country. A scientif gentleman who spent several months in Kansas, and who took daily observatio in ozone, informs me that the amount of ozone in Kansas is greatly in excess that in Michigan. He says that seven hours of exposure of test paper very gen ally secures the maximum amount of coloration. A medical friend who spe several years in Minnesota informs me that the amount of ozone in that State very large. I have, however, no numerical data by which to compare the ozo of Michigan with that of other States.

Dr. Hewitt. of Red Wing, Minn., in the Transactions of American Medical Association for 1871, p. 218, has the following:

"The peculiar atmospheric condition which is the cause of our epidemic influenza is now attracting deserved attention, and it is hoped that the recent offer of a prize by the State Medical Society may result in investigations of practical value. This much is known, that when influenza is *markedly* epidemic, zymotic disease diminishes in severity, becomes less frequent, and disappears. Though as yet no sufficient tests have been used, the majority reporting (judging from its action on 'civic miasm,' which seems that of an oxodizing agent, and from reports of its study elsewhere), believe it to be ozone."

Ozone is found in abundance by the sea, especially where the dash of the waves sends the water into the air in the form of a fine spray. It is found where water by any means is thus "pulverized," *e. g.*, in the neighborhood of water-falls. This may possibly be explained by the fact, now well established, that ozone is soluble to a small extent in water (½ of 1 per cent), and where water is thus converted into spray, this dissolved ozone may be liberated. It may at last be found that the delight which civilized man has ever taken in the thundering of the ocean surf, the roar of the water-fall, or the silvery tinkling of the fountain, has a deeper significance than the gratification of an esthetic taste, and that our sense of the beautiful is thus happily correlated with an important condition of bodily health.

Ozone is seldom found in densely populated cities, or in inhabited rooms, because in both places sufficient putrescible matter is found to destroy or use up all the ozone.

Ozone is not found in large quantity over marshes and swamps durin season of active decomposition of vegetabie matter.

VARIATION IN THE SAME LOCALITY.

The amount of ozone is not uniform in the same locality. In this Stat much more abundant in winter than in summer. It is in inverse ratio to the perature: as the temperature falls the ozone increases, and *vice versa*. Fc greater part of the year there is more ozone by night than by day, but durin weather this condition is reversed.

It would be interesting to know whether the night air of summer is so more unhealthy than that of winter because of this deficiency of ozone by in summer. It is stated that the air over the Dismal Swamp of Carolina loaded with miasm during warm weather, that passengers in the railroad c night are almost certain to contract malarious disease if they ride with th windows open. It would be very interesting to know the amount of ozone the Dismal Swamp by night during the summer months.

The amount of ozone which is present in air at any one time is very According to Houzeau the maximum amount of ozone, even in country only one part by volume in 700,000, or one part by weight in 450,000.

HOW OBSERVED AND RECORDED.

There are several tests which may be employed to detect the presen ozone. Of these I prefer the Schonbein test, because it is the most sensitive because the wide variation of the tint enables us to distinguish small variatio the amount of ozone, and thus secure a number of degrees in our scale.

The Schonbein test paper is prepared by adding ten parts of best qual starch to 200 parts of pure water, heating this till the starch gelatinizes, and dissolving in this one part of pure iodide of potassium (free from iodate). paste is then spread evenly with a flat brush on sheets of paper free from s which are then rapidly dried by stove heat, without exposure to sunlight then stored up in a covered jar and kept from exposure to light.

I make two observations a day, viz.: A "day observation" from 7 A. 2 P. M., and a "night observation" from 9 P. M. to 7 the next morning. I the observation by taking a slip of test paper one-half inch wide and four i long, moistening the paper by rapidly dipping it into pure water, and then ning it up where it will be screened from sunshine, but freely exposed to d daylight and to the air. I moisten the paper before exposure because ozone not form or does not act on perfectly dry substances. At the close of the vation, I dip the paper into clear water, and compare it with the ozone This is drawn on a scale of ten, varying from the lightest perceptibl of purple to the deepest purplish blue of iodide of starch. To fix th servation, ascertain what portion of the scale most nearly corresponds in with the prevailing color of the moist test paper. In making this observati consider the *prevailing color* of the test paper, disregarding the exceptional sp

streaks. The figure on that part of the ozone scale which corresponds in ton with the color of the test paper, is entered in the records for the observation. I there is no discoloration of the test paper, no ozone is present, and a cipher i entered on the record for that observation.

PROPERTIES OF OZONE.

Ozone is an intensely oxidizing agent, capable of effecting at ordinary tem peratures chemical changes of which ordinary oxygen is utterly incapable. I oxidizes all the metals except gold and the platinum group. Even silver is oxi dized by it. It instantly burns phosphuretted hydrogen; oxidizes and destroy sulphuretted hydrogen; oxidizes hydrochloric acid, rendering it capable of di solving gold leaf; oxidizes iodide of potassium, setting free the iodine and form ing caustic potash. I also find that ozone will readily decompose bromides, se ting free bromide, as is shown by the reaction with gelatinized starch. This rea tion with starch is very brief, but the odor of the liberated bromide is very stron Persons at the seaside often observe a strong "cholorous smell" from sea wate It is much more probable that the odor is "*bromous*," from decomposition bromides in sea water by ozone, which is often so abundant by the sea.

I find also, a fact not before observed so far as I am aware, that ozone will, at ordinary temperatures, oxidize the deadly carbonic oxide into the comparatively innocent carbonic dioxide or carbonic acid. Carbonic oxide is one of the most deadly gasses known. Unlike sulphuretted hydrogen, phosphuretted hydrogen, and ammonia of animal origin, it gives no warning of its presence by its odor or other sensible property. The power of ozone to oxidize this deadly gas at ordinary temperatures is a fact of prime importance in preserving the purity of our atmosphere. It has been a question in my mind whether carbonic oxide is not given off with other materials in the mixed gases which escape from decoposing organic matter in swamps, and is not one potent factor in miasm? May not the rapid disappearance of the red globules, and consequent anæmic appearance so often produced by miasmatic diseases be caused by the well known power of carbonic oxide to destroy the red globules? I have had no opportunity to investigate this subject, but I throw out the suggestion for your consideration. But whatever the nature of miasm or malaria, the power of ozone to oxidize carbonic oxide to carbonic acid at ordinary temperatures can not be an unimportant factor in preserving the purity of the air.

Ozone will oxidize ammonia into nitrate of ammonia, and will, in particular, oxidize the ammoniacal compounds which are produced by the decomposition of azotized organic matter. This power of ozone to oxidize the hydrogen compounds of sulphur, phosphorus, and nitrogen, enables it to destroy the offensive products of animal decomposition. Thus it will instantly destroy the horrible smell of rotten eggs. Schonbein found that air made foul by exposure for one minute to four ounces of highly putrid meat, was disinfected by an equal volume of air containing only one part of ozone in 3,240,000 parts of air. Ozone

is, therefore, the natural and effectual destroyer of the products of decomposi azotized substances, which are knowu to be a most fruitful cause of diseas which are supposed to be the medium of propagation of the germ of epi and contagious diseases.

Some investigations of Carey Lea of Philadelphia show that it has a d tive influence on low forms of vegetable life. Simple vegetable structures as mould, are completely destroyed when exposed to an atmosphere cont ozone. It may yet be found that ozone possesses in a high degree the prop a germicide. If this should prove to be the case, its relation to the prevent the spread of contagious and epidemic diseases may be of the greatest valu

DISINFECTANT.

Ozone is a powerful disinfectant. In the words of Fox, "It is nature's deodorizing and purifying principle that oxidizes the emanations from dec ing animal and vegetable substances with which the air is constantly bein taminated, thus rendering them innocuous. The atmosphere would polluted by its admixture with the noxious matters evolved during the pu tive changes which are unceasingly taking place on the globe, as to be unfitt sustaining animal life, were it not for the all-prevading influence of the disinfectant' ozone."

Fownes says: "It possesses the strongest disinfecting powers."

Brande and Taylor say: "It acts as the most powerful disinfectant, a influence in the almosphere is considered to be exerted in oxidizing and dest foul effluvia."

But I need not quote authorities on a point upon which all chemists are a

I have already spoken of the bleaching effect of ozone. According to zeau, ozone has forty times the bleaching power of chlorine. Ozone is the r bleacher, and all organic colors vanish before its persistent action.

PHYSICAL RELATIONS.

In its physical properties ozone is distinguished by its peculiar and po odor: hence its name. Its odor is so powerful that it is said that one par million of air can be distinguished by the smell. It is insoluble in acids and lies, and is destitute of acid or alkaline properties: very sparingly soluble in insoluble in alcohol and ether, soluble in spirits of turpentine, and disolv decomposition in iodide of potassium, iodine being set free and caustic formed. It is readily destroyed by a heat of 500° Fahrenheit, and is des by oxidable substances, especially the unoxidized combinations of hydrogen

RELATIONS TO ANIMAL LIFE.

Ozone has a very irritating influence on the mucous surfaces of the r tory passages when breathed in any concentrated form. I have often fe symptoms of a severe "cold in the head," from accidently breathing t when preparing it for class-room illustration. It often produces the sym of influenza, and it was probably this fact which first directed attention

agent as a possible cause of epidemic influenza. In a very concentrated form i is entirely irrespirable, and speedily causes the death of any animal confined in it

The question of the special relation of ozone to disease, I do not propose t discuss at this time, because I do not think we have a sufficient amount of care fully-observed facts to serve as a basis for any generalization. It is because o this very want of accurate data that I wish to arouse the interest of scientist to gather up and collate the facts in regard to ozone in this State, and, by a care ful and conscientious comparison of these facts with the regional and seasona history of disease in the State, to enable us to arrive at conclusions which ar something more than unfounded assertion or imaginative hypothesis. It seem clear to me that an agent of such amazing power present in variable quantity must have some influence on human health. And when we consider that thi material is present in such variable amount in a medium which enfolds us ever moment of our lives, and whose action "pauses not for matin or for vesper, a noon of day or noon of night," it seems to me that no one can deny that it influence on human health must be most significant.

There are two classes of individuals who have entered with great zeal int this discussion, and who take opposite views in regard to the relation of ozone t health: the one sees in ozone a universally curative agent—the sole condition o health as far as atmospheric agencies are concerned; who claim that ozone means life and health, and that in its absence there stalks forth the pestilence, followed by his shadow death. The other class aver that, because ozone does not always and in all places cause influenza, catarrhs, etc, or prevent in like manner the cholera, typhus, ague, etc., it does not and cannot have any influence on health, and that it is to be summarily dismissed, as an agent having no possible influence on disease or health.

I have spoken of these two classes as antagonistic, and yet they are essentially one. The dogmatist and the doubter are twin brothers.

To hastily affirm, or to lightly deny, is easy work, but each is equally destitute of the plilosophic spirit. To collect one class of facts which will establish the affirmative of a question without reference to an equally large class of facts which go to establish the contrary, is not hard work to do, and is worthless when done. To reverse the process and to collect all the facts which go to establish the negative of a proposition in utter forgetfulness or disregard of counterbalancing facts which go to prove the affirmative, is only to reach results entirely barren of truth. To assert and to deny, to dogmatize and to doubt, are equally valueless as far as the advance of science is concerned.

There is still another class (may their tribe increase!) whose sole aim and endeavor is to discover truth: who are not careful and troubled to establish a given proposition, or to overthrown it, but to answer in part, at least, the grand question which runs through ages, "What is truth?" Without preconceived opinions which shall blind them to the perception of truth, or prevent them from impartially weighing evidence, by patient observation and by skillfully contrived

experiments which are crucial for the detection of truth and the exposure o hood, they are willing to toil that they may be able to make some addition sum of human knowledge. The only way to reach true results which al of value is by extended, varied, careful, and conscientious observation. W will go forth into any field of inquiry bearing this precious seed, "shall de return bearing his sheaves with him."

There is a wide field for observations on this subject in this State. Bu from the observations which are taken at the Agricultural College, I know one other place where daily observations of ozone are now taken, and great pleasure in naming the observer, Dr. John Bell, of Benton Harbo need a score of observers so as to embrace a wide range of climatic and l conditions in the State. I feel I am justified in saying that the State B Health will co-operate with such observers, and give the profession the of the information thus derived.

Of all the various methods of testing and measuring ozone, I pre Schonbein test. It is the easiest prepared and used, and while it may giv tions with other agents than ozone, it gives most delicately and satisfacto measure of the *air purifyers*, which are of especial importance to physician

The questions to be determined and the order of succession in whic should be discussed are:

First, What are the facts in regard to the presence of atmospheric oz this State?

Second, Has the abundance or deficiency of ozone any relation to pr diseases or any influence in modifying the type of prevailing diseases?

Third, Can any benefit be secured to the public health from the fac collated and compared?

By following out such a line of investigation, we may, perhaps, con something that shall be of permanent value to human well-being.

THE SOAP MINES OF CALIFORNIA.

The rock soap mine is situated in the lower mountains or foot hills coast range in Ventura county, five miles from the city of the same name. discovered by A. F. Hubbard while prospecting for coal. He accidenta lodged some that fell into water and dissolved. It being a new experienc rock dissolve, he gave it his attention, found it soapy, took it home to exp with, and soon learned its virtues; yet, strange to tell, his family used it n year before it was given to the public, when Mr. Hubbard associated himse Messrs. Cronk & Bickford, forming the present company, who are sole pro of this wonderful mine. It is accessible only through a canon leading to an ing upon the beech. The coast line stage-road passes the mouth of this three miles below the mine. This canon or ravine penetrates one of the possible volcanic regions. A little stream follows its course, an almost lost

in summer, but in winter a raging, rushing torrent, which, after draining immen heights and many a rugged mountain side, finds its way to the ocean, often be ing along in its fearful strength, huge boulders and entire trees. Along the si of this ravine, sometimes in the bed of the stream, sometimes high up in its pr cipitous banks, winds a little trail leading to the soap mine, traveled only by t safe pack mule and hardy miner. The rock resembles chalk or lime. At t southern extremity is an extensive deposit, veined, marbled, and particolore resembling castile soap. The ledge at its opening is fifteen to twenty feet wi and crops out for 2000 feet, to an unknown depth. The lode is well defined, wit wall rocks of hard slate stone, and has, in common with the slate and sandstor sarata about it, been thrown up from the depths and turned completely on edg In its vicinity is a mountain of gypsum, also turned up on edge; indeed the who country bears evidence of fearful convulsions, also of some time having la peacefully at the bottom of the ocean, for on the highest mountain tops can l found nearly perfect sea shells and various specimens of marine matter.—*S Benveltura*, (*Cal.*), *Reporter in Scientific American.*

STRANGE NATURAL CISTERNS.

In the rough granite country back from Morsamedes, on the west coast of Africa, are some very remarkable natural cisterns. The country itself is peculiar, huge single rocks rising out of the nearly level plain in some places, and in others hills of rock, in several of which deposits of water are found at the very top. A recent traveller visited one of these, and described it as a natural tank with a narrow entrance, containing some three or four hundred gallons of exquisitely clear and cool water. It was covered by vast slabs of granite, from which the rain drained into it during the rainy season; shading the water so that it could not be seen without a torch, and so protected it that the sun cannot evaporate it during the dry season. Thus a bountiful store of excellent water is preserved while there is not a drop to be had elsewhere for miles. A still more remarkable cisten of this sort is that of the Pedra Grande, or Big Stone, some thirty miles from Mossamedes, a huge rounded mass of granite rising out of the sandy plain. On the smooth side of this rock, 20 or 30 feet above the plain, is a circular pit about 10 feet deep and 6 feet across. The rainfall on the rock above the pit drains into it, filling it completely every season. The walls of the pit — which is shaped like a crucible, narrowing gently to the bottom — are perfectly smooth and regular, the inclosing granite being of the closest and hardest description. The cistern will hold several thousand gallons of water. Near by are smaller pits of similar character. Their formation is unexplained. The water of this strange well furnishes the natives and travellers with an abundant supply during the dry season; consequently it is a noted halting place.—*Eclectic.*

METEORIC IRON OF IQUIQUE IN PERU.

BY GUSTAF. ROSE.

This paper was left completed but unpublished by its eminent autho has now been included in the volume issued by the "Gesellschaft Naturfoc der Freunde der Berlin," as the "Festschrift" of its recent centennial meet

This mass of meteoric iron originally weighed twenty-five pounds. part in the museum of the University weighs twenty pounds. It was fou leagues to the east of the village of Iquique near the western boundary Pampa of Tamarngul. Raimondi, the original describer of it, obtained t specific gravity 7.86. In an analysis by Rammelsberg 2.66 per cent. was re by solution of chloride of mercury.

The composition of the parts gave:

Iron.	*Nickel.*	*Phosphorus.*	*Insol. in H*
2.17	0.37	0.05	0.07 — 2

The nickel and cobalt of the insoluble part was found to be 15.49 nick 0.19 cobalt; this left 81.66 for the iron. Raimondi found three pieces o contain 81.42, 85.61, 87.59 of iron, and 18.52, 14.37, 12.38, of nickel.—*Si Journal.*

INFUSORIAL EARTH.

The numerous uses which the silicious remains of the microscopic an known as diatoms or infusoria, have found, is illustrated by the followi given by Gruene and Hagemann, the proprietors of the large German m Oberohe and Hutzel:

1. As pure silica in the finest state of division, it is employed in the ma ture of water-glass, water-glass soap, artificial stone, cements, patty lut ultramarine.

2. Because it is a poor conductor of heat, it is employed for packing and hot air apparatus, and pipes, where it excels every other material in ligh for isolating fire boxes, and catching radiant heat by protecting shields fille the earth, etc.; for filling the space around money safes and ice chests; for and encasing the conduits for melted metals in founderies, and in the labor as a support for heating vessels that break easily.

3. Because of its property of absorbing liquids, in which it surpasses a any other material previously known, it is employed for rapid filtration, r precipitates solid, making dynamite and other explosives, and making colors, because the infusoria take colors like cotton. In surgery it is us absorption bandages and supports. The ability of infusorial earth to take times its own weight of liquid, and to suck it up rapidly without becoming enables it to replace the filter press. It is simply necessary to surround th with a layer of dry infusoria, in order to obtain in a very short space of ti

same result that is obtained by ordinary filtration in days or even weeks. Si drying restores to the infusorial earth its absorptive powers.

4. Owing to its great volume and slight weight, it is employed for pac very fragile objects and glass apparatus, etc., and mixing with plaster of Pari: making light casts.

5. Owing to its fineness it is used as a cheap polish for glass and metal, is an excellent material for cleaning greasy vessels and pieces of machiner *Scientific American.*

DISCOVERY OF HUMAN BONES.

While some workmen were excavating some time ago, in a quarry of Jur: limestone, near Belfast, in France, they discovered an opening in the hill wl it was found led to a cave of larger dimensions. On entering the cavern, its f was discovered covered with human bones, and so disposed as to lead to the b: that the cavern had once been used as a place of sepulchure.

Polished flint weapons, ornaments, and other articles were found, inclu: several beautiful vases, and a mat of rushes. The authorities of Belfast at : took possession of the cavern in the interests of science, and designated Mr. F. Voulot, an archaeologist of renown, to examine the cavern and its contents. There are no doubts but that these are the remains of the polished stone age, and seme are sanguine that further research will bring to light relics of a much older period. One writer in the *Berne Scientific* hopes to find remains belonging not only to this Tertiary, but even to the Crelaceons period. This cavern is situated in a bed of one of the lower strata of the Jurassic period, "on the exact limit of the shore of the ancient Jurassic sea."

NEW DISCOVERY IN AGRICULTURE.

The curious discovery is announced by Prof. P. B. Wilson, of Washington University, Baltimore, that minutely pulverized Silica is taken up in a free state by plants from the soil, and that such silica is assimilated without chemical or other change. The experiment consisted in fertilizing a field of wheat with the iufusorial earth found near Richmond, Virginia. This earth, it is well known, consists of the shells of microscopic marine insects, known as diatoms, which under strong magnifying powers reveal very beautiful forms that have been resolv-ed, clafsified and named.

After the wheat was grown, Prof. Wilson treated the straw with nitric acid, subjected the remains to microscopic test and found therein the same kinds of shells or diatoms that are present in the Richmond earth, except that the larger sized shells were absent; showing that only silica particles below a certain degree of fineness can ascend the sap pores of the plant.

This discovery opens up a new line of research in agricultural investigation from which important results and much additional knowledge may accrue.

REVIEWS AND LITERARY NOTICES.

CLIMATE AND TIME IN THEIR GEOLOGICAL RELATIONS.—A theory of sec changes of the earth's climate; by James Crall, of Her. Majesty's Geolo Survey of Scotland. D. Appleton & Co., N. Y.

Scattered all over our country, from the higher latitudes to the 40th par nuge erratic blocks of massive grantite. These appear on the surface an the drift. They were transported from the North—from the Azoic a the regions where they now repose. We know that the erratic foreigners from northern regions, (1,) because they are not indigeneous, enormous bluffs of granite rock—such, for instance, as Huronian Laurentian Mountains—are exposed in these regions and nowhere else; 3,) because these granite erratics have been traced by scientific men to t Azoic regions.

Besides these boulders there are innumerable scratchings, ploughings, traversing our country in systems; the scratches and grooves of system are always parallel. Systems sometimes cross each other, produ a confusion of scratchings and groovings. And the surface of the rocks frequently planed perfectly smooth.

The question respecting the power which transported these boulders planed, grooved, and striated the rocks, (it has been the unquestioned belief persons qualified for an enlightened opinion upon the subject, that the presen both these phenomena are owing to the same great cause) has ever been a n vexed, and is still an unsettled one. It has been suggested that these er boulders were swept down from higher latitudes by the impetuosity of a mad rent; and that the transportation of these immense masses of rock in this ma produced the planings and groovings mentioned. It being difficult to con of a torrent of sufficient force to transport a mass of granite weighing hundre tons, the theory has long since been abandoned. But granting that suffi power does reside in a given current or torrent to transport said boulders, power would not be a cause adequate to the production of the planings parallel ploughing, grooving, and striation spoken of; for, though the transp boulders might plane, plough, and groove the underlying rocks, inasmuc there would be nothing to retain these masses of rock in a uniform and st course, the scratchings and groovings, instead of presenting the unifor we behold, would be entirely devoid of system or symmetry.

Since it has been demonstrated to be utterly impossible for the masse rocks to be transported by water alone, a theory known as the "iceberg the has been advanced. This theory supposes that these erratics were frozen int ice, and the ice floating into southern regions, melting, dropped them whe we find them. Granting the *possibility* of *transporting* the rocks in this ma the other phoenomena spoken of is not accounted for; because frozen in icel which were driven about at random by the currents, or by the winds, the scra

and striations would present the same confused appearance spoken of bef The theory most satisfactory, and the one which has been universally accepte that known as "the glacier theory." This theory supposes that a glacier, cc nental in extent, once covered the northern portion of our continent; that it for in the higher latitudes and moved towards the tropics; that it took up and tr ported in its southern progress large blocks of granite severed from primit cliffs and hills, and mountains of the north; and that on melting these block rocks were deposited. Granting the existence of such conditions, the scratc and grooves would be parallel—at least all produced by a given contine glacier would be parallel. Granting the glacier, this is all very plausible; whence came the glacier?

It was originally thought that the conditions requisite for the formation such continental glaciers as those of which we have spoken, was brought ab by a northern elevation; but the idea that this was the sole or principal cause continental glaciers was never accredited by many geologists, and was long si abandoned entirely. After the overthrow of this theory, it was suggested that requisite conditions might be produced by secular changes in the obliquity of earth's ecliptic. This theory received the support of the most advanced think of the day, for a season, but eventually went the way of its predecessors. It is now maintained that the requisite conditions are produced by the variations of the eccentricity of the earth's orbit. When the northern hemisphere has its winter solstice in aphelion, during a cycle of extreme eccentricity, the sun will be 14,212,700 miles farther away than when the winter solstice of the same hemispheres occurred in perihelion during a cycle of extreme eccentricity. Consequently, when this hemisphere has its winter in perihelion during the time of maximum eccentricity, the amount of glaciation must be far less than when it has its winter in aphelion during the same maximum eccentricity.

The investigations of Herschel, Humboldt, Arago, Lyell, and others came near overthrowing this theory by demonstrating that neither increase or dimnution of the earth's eccentricity, could influence to any great extent the amount of heat received by the two hemispheres,. But our author has redeemed the theory by showing satisfactorily that a considerable increase of the earth's eccentricity beyond that which it has at present, would so modify the currents of the ocean as to greatly increase the amount of snow and ice in the northern hemisphere, and diminish proportionately the amount in the southern hemisphere. Not only this, but he has also established the periodicity of the recurrence of a glacial epoch. His work is a contribution of permanent value to geological science.

PRINCIPIA, OR BASIS OF SOCIAL SCIENCE.—By R. G. Wright, second edition, Lippincott & Co., Philadelphia, 1876.

This is the unsuccessful attempt of a thinker unquestionably of ability to construct a system of social science which shall embody fundamental principles of universal application, a thing as visionary as Plato's "Republic," as improbable as Swift's "Lillypute," and as impossible as Mare's "Utopia."

"The world was made in six days," all things dance to the tune of six, Mr. Wright's system of sociology is founded upon "singular sixes." "This f which gives the maximum of internal content with the minnimum amou external surface of similar bodies joined together is a HEXAGON." [Aut majuscules.] Our "sixistic" philosopher informs us that "in developed civ tion there is six great classes of society," but provokingly stops short here, int hat the public will hear about these six classes in a future work. One o eatures of Mr. Wright, is his habit of adroitly arousing the curiosi eader, and about the time he is beginning to exult with the idea of some ıew, he cooly drops the subject, remarking "this will be portrayed in an ook." There are six fundamental motors of common passions. There ar nfinities, to wit: "diefic spirit, soul spirit, matter, space, duration, and divers There are six organs of sense (the idea that there are but five is an exploded fog ensation, temperature, taste, smell, hearing and sight. There are six cryst dimetric, trimetric, monoclinic, triclinic, and hexag ıre six religious societies—Adam, Adam and Eve, Patriarchy, Isra Egypt, Israel in Palestine, and the Christian Church. And, of course, there six social units—the individual, the family, the social circle, the precinct, nation and mankind.

To Mr. Wright belongs the honor of a felicitous and satisfactory explan of the fundamental causes of the late civil war; it arose from the "negle precinct by both the North and the South." (?)

Mr. Wright's style is barbarous, tumultuary, and ungrammatical; his th incoherent, crude, and curbryonic; his terms confused; his meaning frequ obscure; and the book in many places a puzzle.

The author of "Principia," is unquestionably a well intentioned man; although he has failed to establish his theories, his book is a valuable contrib to the science of socialogy—if knowledge as involved and uncertain may be c fied with the title of science. Many of the topics discussed are thorou practical, and have a bearing upon the important political questions which a the public mind. We learn from the preface, that the author endeavored to duce a work which would not offend the political, religious, or scientific sen ties of any one; consequently he embraces with equal tenderness the Cat monk, the Mormon prophet, the Oneida free-lover, the French communist the scientific monist. His self-imposed task is one which Herbert Spence great light in sociological law, could not accomplish, and his pandering t predjudices of his readers is as repulsive to the reader of unbiased mind a caress of a Yahoo was offensive to Dean Swift.

A MANUAL OF THE VERTEBRATES OF THE NORTHERN UNITED STATES, in ing the district east of the Mississippi river and north of North Carolina and nessee, exclusive of the marine species, by David Starr Jordon, M. S. M 1 Vol., 12 mo., 342 pages, $2.00; Jansen, McClurg & Co., Chicago, Ill., 18

The purpose of this work is to reduce the labor of classifying and
ing the name of species. It fills a place long left unsupplied, and is
to the student. The descriptions are brief but comprehensive and
describes 817 species representing 116 families, and to obtain
these it would be necessary, without this little volume, to possess quite
costing many times what is asked for this one book; besides all this, it
work containing the names and descriptions of all our reptiles and
fishes. The student is guided by artificial keys to the different
and species, similar to the system so sucessfully adopted by botonists.
to the work is also a glossary of scientific terms.

SALVATION BY CHRIST.—Discourses by Francis Wayland. D.
Boston, 1876.

Some years ago Dr. Wayland delivered a series of lecture
most important Christian doctrines, to the students of the University at
R. I. These discourses were collected into a volume and published
title of "University Sermons."

These discourses have been thoroughly revised and
omissions and additions, rechristened and sent forth an old man with a
and a new name. They are well considered and skilfully amplified, and
the confidence and respect of the reader, although they may not carry
and should be read by all students for the ministry and all lovers of
writings.

BULLETIN OF THE NUTTALL ORNITHOLOGICAL CLUB.—We have
second number of this journal; it is a very instructive and interesting
consisting of twenty-four pages. The prospectus tells us that while
will consist mainly of communications from resident and corresponding
of the club, it will embrace occasionally selected articles of special
value; it will also include reviews of recent ornithological publications.
papers read before societies; in fact a general magizine of ornithology.
a year; address H. B. Baily, Boston.

OUR DUMB ANIMALS—A monthly issued by the Boston Society for
of Cruelty to Animals. A very entertaining and instructive paper, and
moreover, is doing a grand, good and humane work. We wish it

THE MORAL ASPECTS OF VIVISECTION—By F. P. Cobbe. Reprint
English edition. This an able and telling argument against the
vivisection, and should have a wide circulation.

NOTES.

The foolish and cruel custom of wearing the wings, feathers, heads o entire bodies of birds upon the hats and head-dresses of ladies cannot be too sev condemned. The great numbers of these innocent and beautiful denizens of woods and forests that are thus needlessly destroyed to satisfy a foolish fash become something fearful to contemplate; and, if kept up, threatens to de whole districts of the small birds. We think if the tender-hearted ladies w a moment upon the untold suffering they cause the number of hel birds left without parents to starve for the want of nourishment (for it spring that the birds are in the best plumage, and, heedless of laws to the the collectors then capture their prey), the vast number of sweet little s who not only tend, by their bright and graceful forms and sweet note and enhance our walks in the country, but by the vast number of in destroy, render inestimable aid to mankind, they would cast aside t ornaments, and forever refuse again to mar their beauty by such ou place appendages—revolting, because these beautiful birds seem out of place w perched upon a hat. Their true home is the wild groves and forests. The bodies, the dried skins, of these once happy, innocent little beings—the joy gleesome musicians of the woods and groves, who gladden our hearts by heavenly strains—seem sadly out of place, stiff and cold, perched upon a la hat. No true, tender-hearted woman would, for a moment, suffer one to be thus upon her head. Their true place is in the free, open air—their true mis to beautify, by their happy, innocent lives, this fair world. Then, it is known to preserve the feathers in their best condition, the birds intended for ladies' are often *flayed alive!!* How more innocent and beautiful would tender, kind loving women appear, would they spare all such inappropriate adornments, lending her powerful aid upon the side of mercy and humanity, adorn her pe with flowers and other more suitable ornaments. If ladies would, one and al example, refuse to buy or wear birds, the traffic in these beautiful little inno would soon cease for want of customers. It is said that more birds are *slaugh for the milliners than for all other purposes combined.*

DEEP-SEA SOUNDINGS.—One result of the soundings that have been as ously carried on by the Challenger expedition has been to establish the fact the mineral character of the sea-bottom is of two principal kinds: In the one myriads of shell-cases of *globigerina* and other minute objects make up a gr mud known as the "globigerine ooze," found at depths up to 2,000 fathoms. yond that the foraminiferous shells entirely disappear, and the bottom yields o chocolate-colored mud. The tow-net meantime showed clearly that the li *Foraminifera* are exclusively distributed on the surface of the ocean. As the cases of dead forms sink to the bottom, whatever its depth, it is necessary to acc for the disappearance of the shells when the soundings were beyond 2,000 fath

Prof. Wyville Thomson, having ascertained that water brought up yielded an excess of carbonic acid, is of opinion that this acid carbonate of lime of the shell; the deposition of the remaining form of mud naturally following. Prior to these researches it was lieved that the *Foraminifera* lived at the bottom, and were but partially Now it is known that in certain latitudes they are generally distributed state on the surface, and that their dead cases at one depth are and at another only in the decomposed state. The geographical interesting creatures has been found by the expedition to extend from up to about 45° of latitude. In the antarctic circle they replaced by *Diatomaceæ* and other vegetable forms.—*Tribune.*

Science is undoubtedly at this hour the ruling passion of the age. chase, war, art, and learning have been in various past epochs, so is of physicial knowledge in our generation. The triumphs thereby dazzled us, as the people of France were dazzled by the victories Napoleon; and even such of us as understand but very imperfectly boasted conquests consist, are ready like our betters to cast our palms of the new Messiah, and shout "Hosanna!" albeit we have too believe that he "cometh in the name of the Lord."

If any men may claim to be more than others, the period, in the "foremost files of time," it is our men of science. * What is done, thought, felt, by the men of science is almost of in determining the proximate tendencies of the masses.—*Frances*

The progress of the Conchma plantations in India, has been such learn from a paper read to the Society of Arts by Mr. Markham, they one-hundred and forty thousand pounds of bark a year, with a tendency The advantage of cultivation over the crop of wild bark formerly slope of the Andes, is therefore most strikingly demonstrated, and Mr. now advocates a similar experiment with the caoutchouc or The demand for India-rubber increases every year and the supply a diminishes. It is to be hoped, therefore, that the measures already establish plantations of caoutchouc in the hot and moist hill-districts will be persevered with until a sufficient quantity shall be grown and improved. The best kind of caoutchouc grows in South America.

The leaves of the eucalyptus globules contain an oil possessing septic powers; it will preserve blood and pus as long as carbolic acid, the appearance of fungi and vibrios.

Where a very long conductor is used, electricity has been found to the velocity of 288,000 miles a second.

As the discovery of the metal gallium may justly be regarded as the mo portant chemical achievement of the last year, all facts regarding it are re with special interest. M. Lecoq de Boibandrau, whose name is associated the discovery, recently communicated to the French Academy, the following regarding its physical and chemical properties.

"Pure gallium, of which he had now prepared nearly one and one-half g melts at about 85° Fahr.; hence it liquefies when it is seized between the fi It is very easily held in superfusion, which explains how a globule has beer liquid for weeks in temperatures descending occasionally almost to zero.

Electrolyzed gallium from ammoniacal solution is identical with that obt from polassic solution. Once solidified the metal is hard and resistant, eve few degress under its melting point; but it can be cut, and has a certain mal ity. Melted gallium adheres easily to glass, on which it forms a beautiful n whiter than that produced by mercury. Heated to a bright red in presence gallium oxidizes but very superficially, and does not volatilize; it is not se attacked in the cold state by nitric acid, but in heat the solution operates liberation of nitrous vapors. The density of the metal, determined approxim is 4.7 at 15°, and relatively to water at 15°. The mean of the densities of inium and of indium is 4.8 at zero. Thus the density confirms theoretical p ion, while the extreme posibility is a fact completely unexpected."

It will be seen that the only practical value of gallium, as yet determin its possible service in the preparation of reflecting surfaces—the first pro being, therefore, the discovery of a process by which it can be economicall tained.—*Appleton's Journal.*

M. Plante', as the result of an interesting series of experimental observa advances the theory that the aurora borealis is produced by a flow of positive tricity through the upper regions of the atmosphere into planetary space. illustrate this, he plunges the negative wire of a powerful induction coil, in a v of water, and brings the positive wire into contact with the surface. As a re he is able to reproduce the most markcd phenomena of the aurora, especiall streamers and the dark arc around the electrode. M. Plante', therefore, c that all the planets are charged with positive electricity, and that this flow from the neighborhood of the magnetic poles either in forms of obscure when no resistance is interposed, or as an aurora when it encounters mass water or vapor.—*Appleton's Journal.*

Prof. Flower, in closing the Hunterian Lectures on the relation of Extin Existing Mammalia, delivered at the Royal College of Surgeons, recently, s "No actual remains of man have been met with which can be said with certa to be older than the pleistocene period; though it is asserted that his exist upon the earth in the pliocene and even miocene epoch is proved by works o found in deposits of those ages. The oldest known remains of man from E

pean caves (with perhaps the exce
which is doubtful) do not differ m
est modern races. In other wor
a race of men inferior in general
nearer approach to the lower ani

The amount of good a sing
human race, is inestimable, and
will destroy more noxious insects
grain and fruit they eat is far ov
left to multiply, would soon dest
ren desert. The swallow, night-
their whole lives are given in the
to spare the birds. Not one sho

Prof. Ramsay says that the
at the present day, notwithsta
to subsequent upheaval. He fi
extensive denudation during th
thickness of fresh water and ma
Switzerland, formed by the deg
strata, an elevation of 5,000 fee
the Pliocene and past Pliocene

A body descending from a
of time, three times sixteen in t
sixteen in the fourth, and so
numbers, 1, 3, 5, 7, 9, 11, &c.,
a body requires to descend from
of the place in question. The t
or stone discharged into the air

There will be a meeting of
ation for the advancement of sci
ested in the subject of Entomol
at first to the Tifft House for in
and are well attended. The sub
and should receive attention from
Prof. J. L. Le Conte, Pres., and

The approaching meeting of
of Science, at Buffalo, New York,
portance. Committees have bee

citizens, to arrange for the comfort and enjoyment of their guests, while atten the meetings; excursions are planned, and no pains will be spared to make occasion one to be long remembered as of profit and enjoyment. The mee opens on the 19th of August, 1876, and will probably last about 10 days.

The subject of vivisection, or the performance of surgical operations upon living animals, is justly receiving much attention in England ..is country. It is a grave question whether the small benefit derived from t operations justifies the vast amount of suffering entailed upon the inno nelpless victims.

Sound travels about thirteen miles a minute; so that if we hear a clap of t ler half a minute after the flash we may calculate that the discharge of electr s six and a half miles off. It is noticed that the flash of a cannon fired at ance from the beholder is seen some seconds before the discharge is heard.

In one second of time, at one beat of the clock, light travels over a spa 192,000 miles. If a cannon ball were fired towards the sun, and should mai its full speed, it would take twenty years for it to reach that luminary, and yet travels through this vast space in seven or eight minutes.

METEORITES.—A meteorite which fell near Virba (?), in Turkey, has described before the Academy of Sciences of Paris, by Danbrice. It has a gr silicated exterior and contains numerous grains of nickelerous, iron and sul of iron. It contained also some grains of chromic iron.

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and Scientific World.—*Toledo Blade.*

should have noticed earlier the reception of a new monthly devoted t
of Natural Science, published in our city, under the editorial managen
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with interesting material, furnished by home and foreign contribu
promise of the development of a valuable work in our midst.—*To*

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reats mainly upon the various classes of animated nature, which it deser
thoroughly practical manner.—*Oologist.*

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devoted to the natural sciences, and published in Toledo, deserves a favor
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to pages of original and selected matter, contributed by the ablest writer
n our country.—*Chicago Tribune.*

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receive so elegant, and magnificently illustrated a scientific magazine from a
that only a few years since was regarded in the back-woods. Taking up a num
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one interesting article after another until the wee small hours of the mornin
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E. H. FITCH, at Toledo, Ohio. This is a new publication devoted to the inter
Natural Science. The number before us is a model of typographical neatness,
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writers are employed as contributors to this periodical. It deserves, and we hop
will meet with success, as it is certainly one of the ablest productions of its kin
he country. Each number contains fifty-six pages, and is furnished for the
price of three dollars per year.—*Independent Sentinel, Pittsburgh.*

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VOL. 1. No. 12

SEPTEMBER, 1876.

THE SCIENTIFIC MONTHLY

A MAGAZINE DEVOTED TO

The Natural Sciences.

E. H. FITCH, Editor and Proprietor.

TOLEDO, OHIO:
TOLEDO COMMERCIAL COMPANY, PRINTERS.

The Scientific Monthly.

VOL. I.

Price, $3.00 a Year; or, 30 Cents a Number.

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The editor is not responsible for the views, statements or opinions se the articles of contributors, nor does their insertion in these pages ply an endorsement by the editor.

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The Scientific Monthly

DEVOTED TO THE NATURAL SCIENCES.

VOL. I. SEPTEMBER, 1876. N

THE ANCIENT MEN OF THE GREAT LAKES.

HENRY GILLMAN.

Long before the advent of the white man upon this Continent, long l the American Indians roamed through the forests, the country was peopled v strange race of men, long since extinct. So remote is the time when this st people inhabited our land, that no tradition of their existence is preserved a the present Indians, and it is more than probable that they had long since p away upon the advent of those people. But of whose existence many relics ar silent but protent witnesses of their former numbers and power. That they a more settled race and more acquainted with the arts than the Indi made manifest by their now crumbling structures, articles of domestic use war. Where they came from, or when and how they disappeared, are fact unsolved. But scattered all over our country are their works in the sha mounds, earth works and forts. The following article of Mr. Gillman, read l the American Association for the advancement of Science, gives some impo facts about this interesting and almost unknown race of beings, who once th peopled the shores of our great lakes. But we will let our author speak for hir

In former papers, in placing upon record some of the more important c discoveries of the writer relating to the ancient inhabitants of the regio the Great Lakes, and especially when dwelling on the remarkable knowl enterprise and patient endeavor displayed in the works of the "Ancient Mi of Lake Superior, it has not been neglected to call attention to the point we have here to deal with a people differing essentially from the North A can Indian, as we have ever known him. In discussing some of the le facts lately revealed at Isle Royale, the identity with the mound builders c

ceived opinion, unless an unanticipated ove
should be disclosed.

We would now present a brief summary
unnecessarily dwelling on those to which we
ous scientific directions, adding such inferenc

The great mound on the river Rouge ne
has proved a fruitful source of relics of the m
tened tibiae here exhumed by the writer, first
tycnemism being a characteristic of our Nort
indeed, the word platycnemism (first used by
in even our scientific literature. Some of th
Peabody Museum, at Cambridge, at once attr
ed Wyman, he making them the subject of a
in the winter of 1869.

But it was more than the discovery
pertaining to the ancient men of our region;
a degree unheard of—I might almost say u
country or of the world. In many of the n
tibiae with sabre-like curvature, which I ha
verse diameter was only 0.48 of the antero-
most marked and isolated case recorded by
France, it was 0.60. In the Chimpanzee a
Shortly afterward even this extreme degre
by my bringing to light, from a moun
among a number of the flattened tibiae, tw
latitudinal indices were respectfully 0.42 a
the mounds mentioned, a tibiae without this
of later burial, and of less antiquity; while i
try, the flattening has been estimated as pert

My discovering, a few years afterward, the remarkable series of tumuli . St. Clair River and Lake Huron, farther extended the area over which plat mic man had originally ranged. Here, though not to the extreme noted o Detroit and Rogue Rivers, the flattening of the tibiae was most decided. area was again further extended by my lately (1874) finding the tibiae fr ancient mound on Chambers Island, Green Bay, marked by the peculiar flatt

In all those mounds I find that the femora, at the upper end of the also, frequently present a compression, though to a much slighter degree tha observed in the tibiae. The same peculiarity has been noticed by Busk in the a Welsh interments, a point not to be overlooked in considering this characteri the bone. With a few exceptions in all the mounds, also, were found such as stone implements, pottery, mica, ornaments, (necklaces) made of perf teeth, shell, and small bones, as well as not unskillfully wrought beads of c an implement of the same metal being occasionally exhumed.

Of the more important of our collections in this branch of science, belo to the Detroit Scientific Association, those presented by Mr. D. F. Henry a serving of special mention. They consist of a variety of objects obtained fro ancient mound on Chambers Island, in Green Bay, Wisconsin, and embracin crania and other bones of man, pottery, stone implements, and a copper This last object is of the pointed pattern usually found among the relics mound builders, and is formed simply by being beaten into shape, appa without the agency of fire.

Not a vestige remained of the handle, which, probably had been ma wood, and had, it is presumed, long previously decayed. Small portions of sort of leather, the prepared hide of some unknown animal, adhered to the through the action of the oxidation, which, doubtless had also the effect o serving those fragments. These are, unquestionably, the remnants of the which once protected this (to those aboriginal men) valuable tool.

The compression of the tibiae known as platycnemism, though not pr by the Chambers Island specimens approaching to the degree which I find specimens from the Rouge and Detroit Rivers, and though some what ex by similar specimens which I have taken from the mounds of the St. Clai is yet exhibited by them slightly in excess of such bones from other (more erly) parts of the country as given by Wyman. The last mentioned present the flatness of the ancient bones from Denbigshire, Wales, as given by which, in turn, are much flatter than the modern English tibiae. The me tudinal index of four well preserved tibiae from the Chambers Island mo .588; while their mean perimetral index (denoting the bulk or build bone) is .205. In nine specimens from the Detroit and Rouge Rivers the latitudinal index is .486; the perimetral index equalling .185; while in that ex case from the Rouge the latitudinal index is .402.

I find, as I have elsewhere stated, that in the ancient tibiae from our can mounds, the slenderness of the bone appears to be related in some deg

and Rouge Rivers, and those from th
the American specimens which have c
platycnemism was accompanied by a re
thinning out of it, if I may use the expr
dilated on this peculiarity, developed in
unknown in any other part of the w
sonian Report for 1873, given with oth
which I have carefully prepared from
content with this simple reference.

It is of moment to note that I fin
the Detroit and Rouge Rivers, the p
peculiarity of the arm-bone in which
fossae at its lower end.

It is difficult to arrive at the amou
in these mounds; though I consider
are of this character. This is of inte
mounds in other parts of the country
one per cent. It is a characteristic w
pertains to the negro in large degre
while it is very rarely encountered in
last year from Prof. Busk, F. R. S., he
being a peculiarity of platycnemic ma
conincidence has been noticed elswhe
absolutely established. I also find in
may so call them; that is, instances
fossae is not quite completed, the divid
very thin partition, almost transparen
plished, there is a great variation in th
crania from the Chambers Island mour

be .786, thus barely escaping being brachy-cephalic, and placing them with orthocephalic range, the altitudinal index being .802. In several indi instances, however, the rule holds good, and there is much variation betwe different skulls. In respect to the mean capacity of the Chambers Island which I have ascertained approximately, they exceed but very slightly that crania from the Rouge; and both would fall below that of the Tasmanian, only very little in excess of that of the Hottentot. But we must not be decei this. I have lately had occasion, on a similar theme, to call attention to th that cranial capacity must not be implicitly regarded as of physiological i Otherwise we should have presented the anomaly of the civilized, refined Pe with a skull the cubic contents of which are nearly identical with those Australians and Hottentots, and are largely exceeded by those of the brutal American Indian. To quote from the late Jeffreys Wyman in dealing wit facts, "Unless the quality of the brain can be represented at the same ti the quantity, brain measurement cannot be assumed as an indication of the lectual position of races any more than of individuals. * * * brains of Cuvier and Schiller were of the maximum size, so were those of unknown individuals from the common cemeteries of Paris, while that of was but slightly above the mean, and Byron's was probably even below it."

It is noteworthy that, in contrast to the modern Indian skull, and als crania from the mounds in Kentucky and Florida, as given by Wyman, t little indicating inferiority, in simian tendency in the position of the foramen num of the crania from the Chambers Island mound. Its index in the Cha Island skulls is .422. This need not be regarded as anomalous. Those tr a lower condition are not expected to be found associated in any one ra are they so found. It is well known, for instance, that in the Negro, w general simian characteristics, the foramen magnum has nearly as forward tion as in the Caucasian.

In the Chambers Island skulls I find present an interesting deformat this foramen, which, so far as I am aware has not hitherto been observe was for the first time brought to notice by me last winter (1874). I refe elongation of the foramen, generally in an anterodexter and sinister-po direction; so that this opening partakes more or less of an elliptical form. crania from the Rouge mound, I find either no such peculiarity, or but sli casional indication of it. After some speculation as to what this distortion signify, I came to the conclusion that, in all probability, it arose from some ed habit long persisted in. And what so natural as to ascribe it to the associated with the method to which those primitive men resorted in capturi animals and birds which supplied so important a part of their food? The the bow in hunting became with those men almost a business. All day lon for day after day, from childhood to old age, with the majority of the m this people, this weapon was an inseparable companion. Is it too much that the attitude so frequently assumed in bending the bow and directi

arrow in its flight, the head thro
cord in the foramen magnum?
constant cause as its origin.

It would be important to nc
other races in which the use c
habit, strengthening with succ
intensified the curious eccentricit
which I consider the more ancie
would apparently imply. These
connection with this peculiarity
large amount of material from v
now allude to this peculiarity in
having means of verifying my
crania in their collections. I ha
tables in which the dimensions
given.

Their discussion is, howev
when I hope to be able to el
touched *en passant*. I would ad
presents an epactal bone. This
of the Incas, is generally consi

Before dismissing the crani
betoken a singular practice co
ginal inhabitants of this country
the books, notwithstanding the
able marks which would remain
to. I have reference to the arti
The circular aperture, evidently
ment, varies in size, in some sk
half of an inch, or more, and
invariably placed in a central po
of its being brought to my know
great mound on the River R
exhibited this perforation. A sk
Mr. Davis, and which was exh
Huron, Mich., also has this marl
the same mound, all being simila
no other remains interred with
further excavations made in the
other relics exhumed were eight
remaining bones belonging with
that many were wanting, and tha
the usual manner of burial, seemi

to being denuded of the flesh and other soft parts of the body. Besides the going instances of this curious custom, which have been brought immedi to my knowledge. I have since been informed of a skull having been f at Saginaw, Mich., which presented the peculiarity; but in this case there three perforations arranged in cocoa nut fashion.

The skull from the Sable River mound is of a dark color; and its latitudi cephalic index, .770, would place it within the orthocephalic or medium r the altitudinal index being inferior, or exactly .745. The foramen mag approaches a central position, its index being .445. The two perfect speci rom the River Rouge are decidedly brachy-cephalic, the cephalic indices l respectively, .822 and .853, the altitudinal indices being inferior, or respec .733 and .828, while the indices of the foramen magnum are, in the first ins .465, and in the second .397.

It is to be hoped in thus calling attention to this singular custom, fu information will be elicited; and I take this opportunity of earnestly solicitin communications of any facts bearing on the subject.

In resuming the excavation of the great mound at the River Rouge opening was made at what was persumed to be its original center. At the dep three feet, human bones, much decayed (though including the eight nearly pe crania already mentioned,) with fragments of pottery and a few stone i ments were exhumed. At four feet deep occurred abundant evidence of cr tion in the presence of masses of burnt human remains and ashes with charc compact, discolored agglomerations, separated from each other by the surrou pure sand of the mound. The average bulk of those spheroidal bodies in v fragments of burnt bone abounded, gave a length of two feet, a breadth of and a half feet, and a height of one and a quarter feet. Beneath those pec interments which had remained undisturbed, nothing but sand was encoun for four feet additional depth, or a total of eight feet from the surface. At depth white lime-like masses, each of a few inches in circumference, were rea They had little resemblance to bone, though subsequent examination proved to be such, and of man. In a few cases the remains of the exfoliated ce tissue were quite apparent, while the outlines of portions of some of the prin bones could be sufficiently recognized to determine whether they belonged to femur, tibia, fibula, humerus or ulna; but in a majority of instances, those remai our brother man, (of which there were considerable quantities) had returne "dying Nature's earth and lime,"—had obeyed the infinite decree: "dust thou and unto dust shalt thou return."

These, in general ball-like masses continued to the depth of ten and a feet, where operations were suspended. Over the greater part of what is le this mound, and about eighteen inches from the present surface, occurs an al continuous bed or stratum of burnt bones and ashes with intermingled ments of pottery.

I have already, (in 1869 and subsequently), called attention to the evide of the practice of cremation in the burials here, and it is unnecessary th

pointed out by Mr. Hubbard, is an interesting example of the plan is an irregular ellipse, the greater diameter slightly west of north, and east of south, or nearly at r of the river, the less diameter being 250 feet in lengt embankment is but three feet high where best preserv of twelve feet, and is surrounded by a ditch like depr Oak trees of one and a half feet in diameter are now g the embankment. In an oak tree which had been fe were counted. These trees appear to be of the "sec that this "enclosure" was known to the early white forests had been destroyed.

Mr. Davis and the writer have presented to the I the massive stone mauls and other relics, from the mining pits in Isle Royale, Lake Superior. Such re such immediate interest, as there have been made, account such as this; but for details, respectful refere the paper entitled "Ancient Works at Isle Royale," pr Aug. 9, 1873, and to the paper printed in the Smiths

I cannot close, however, without expressing my relic, which taken in connection with our former disc most important evidences of the character of the "a their work, and the richness of the mineral field selected Late last autumn, there was brought to our city a mass c part of the summer was taken from an ancient pit on the ing Company at McCargo's Cove, Isle Royale. On clea ulated debris, this mass was found at the bottom, at th half feet. It is of a crescent-like shape, and weighs 5720 pounds. Such a huge mass was evidently beyon

men to remove; they could only deal with it as best they knew how. And as to mode of proceedure, the surroundings in the pit and the corrugated surface of mass itself bear ample testimony. The large quanties of ashes and charcoal around it, show that the action of fire had been brought to bear on it; a great ber of stone hammers or mauls were also found near by, many of them frac from use. With these the surface of the mass had evidently been beaten up projecting ridges, and then broken off. The entire upper face and sides of the present repeated instances of this; the depressions, several inches deep, and intervening elevations with their fractured summits, covering every foot of exposed superficies. How much of the original mass was removed in the ma described, it is, of course, impossible to say, but from appearances, in all probal it had, at least, been one-third larger. Innumerable fragments of copper chip strewn on all sides; and even the scales of fish, evidently the remnants of meals of the miners, were recovered from the pit.

EXISTENCE OF GLACIAL ACTION UPON THE SUMMIT OF WASHINGTON, N. H.

BY PROF. C. H. HITCHCOCK, OF HANOVER, N. H.

Mount Washington, in New Hampshire, 6,293 feet above the sea, is the est eminence in the North American area swept by ice in the glacial era, h observers have examined it carefully with reference to the discovery of evid of ice action; because it has seemed to stand alone in the midst of the g sheet, and enable us to place bench-marks upon it to show the height of the The unanimous consent of all observers previous to the present moment has in favor of its isolation in the glacial sea, the ice reaching different altitudes ac ing to different authors. In 1842 my father described, before the American ciation for the Advancement of Science, the striation and embossment of ledges near the Lakes of the Clouds, about 5,200 feet above the sea. Ho the theory of submergence, he supposed Mt. Washington to have been an i in the midst of an Arctic Sea, full of icebergs, but that we had evidence of other island in New England than this. I have heard him say often, th present appearance, covered by numerous angular fragments split off the c by the action of frost, illustrated forcibly what the general aspect of the v country would have been, had not the ice removed the debris and ground up transported fragments into earth suitable for the growth of vegetation. I am aware that any author has described the glacial phenomena upon this mou essentially different from that just mentioned, while others have held differen ories to account for them.*

* The above forcibly illustrates the immense thickness and great power of the vast glacial sheet whi covered the northern parts of the North American Continent. It probably extended from the Arctic O the northern limits of North Carolina and Tennessee, and from ocean to ocean, producing a marke both in the climate and the fauna and flora of the Continent.

rection, but no striæ were seen upon them. At
the summit were the Tip-top and Summit houses,
corporation had not built their depot, and scarc
been turned over, so as to permit one to see the
In fact it was supposed generally that the summ
ledge, strewn over with immense angular blocks,
any appreciable distance, save as they had rolle
seen this summit can recall from memory, far bet
piles of giant debris, covered with lichens and a
picture of icy desolation. Nothing foreign show
out the removal of these large fragments no on
have been awaiting their present development.
evidence exists to show that the glacial ice moved over

The first suggestion of this novel proposition
1875, from an examination of the somewhat rou
along the carriage road upon the northeast side o
dred and fifty feet below the summit. I stumble
gneiss, foreign to the mountain, one nearly ten
This raised the altitude at which transported mate
Observations showed that these boulders came in
lying the conspicuous angular debris common all
trees. In repairing the road the workmen us
blocks before obtaining a material suitable for
seemed to be plenty of it.*

---

*The study of the surface of the earth has unfolded a deeply i
are introduced to scenes that ... in the strang... contrast to w
through ages gone by ... nd physical ... f the
vision; we see island... ...ed with
ice, having ... ime well w
and ... ...ere united
... ...ater po... ...ith all the n
... ...rctic Ocean ...loat ...afts
bove th... ...on

This earth proves to be the ordinary ground moraine of modern glacia
full of the worn angular and roundish stones which have been fashioned pecul
by being shoved along. Large boulders are not common in it, though abun
elsewhere. These stones are usually of the same mica—schist and gneissic r
that compose the adjacent ledges; and this kind of ledge extends to Israel's R
five or six miles distant from the top of Mt. Washington in a northwesterly d
tion. Were these deposits situated in the low lands, they would be pronounce
irst sight, by any one, to be the common drift heaps of the neighborhood. I
not not discover satisfactory evidences of striation upon the few stones picke
ear the two boulders of granite just mentioned, but they possess the characte
of those that are covered with scratches elsewhere. Some are pointe
oth ends, being either flattened or round along the middle. Others are squ
r trapezoidal, with rounded corners. Many resemble perfectly the shapes fig
y Geikie in his recent work on "The Great Ice Age;" and in fact they
f the constantly occurring forms familiar to all glacialists. The rock is quite
nd that fact may explain the absence of striation.

The question naturally arose as I lifted up these stones, Are these the sh
esulting from the cleavage of ledges by frost? No, it could not be; some ag
f transportation other than the falling down the slope has worn off the ec
smoothed their surfaces, and mixed them with earth. The glacier ice must
ransported them, though they can not have traveled more than five or six m
r the limit of the extent of this kind of rock. If this were so, then the w
f Mt. Washington was covered by the glacier ice. Thus I reasoned with my
and began to look further. Remembering that these glaciated stones came
below the surface, I sought for localities where the lower earth had been excav
The first case examined was the foundation of the Mount Washington Hotel.
laying the foundation of this edifice—nearly two hundred feet long—the an
debris was first taken up and placed in the cellar walls. When this had been
up the workmen reached the same moraine mass which occurs below, along
carriage road. Some of the earth was sandy, and went into the composition o
mortar used on the walls. There was scarcely any ledge requiring removal
examined such of the stones as remained in the cellar, as well as possible wi
dim lantern, and found everything in agreement with the character of the n
rials seen 250 feet lower, along the carriage-road. The stones assumed the
nary glaciated shapes, but I did not discover any material foreign to the moun
One of the quartz fragments seemed to show traces of smoothing or inci
striation.

Next I examined the excavations made for the road between the house
stables, and obtained several small boulders, four or five inches long, corresp
ing in mineral structure with the ledges in Randolph and Jefferson, twelve
teen miles away. The general color of the rock is so like that of the mou
that one would not perceive the difference between them without close inspec
The mica is arranged differently in it, the white parts are more abundant, th
in fine grains, and the rock is evidently the same with the upper member of

stones, composed of the same material wit
along this road to the stables, and elsewhe

Being unexpectedly called away I had
upon the ledges. Just beyond the Signal
sloping a little northwesterly and precipi
agencies have marred the surface so much
ever existed. I had proposed to scrutinize
a lens, as this course sometimes reveals str
ing. Were this ledge situated near the La
common, I should point it out unhesitat
though much degraded by weathering. T
of glaciated ledges in other parts of the
farther north resemble this one. In as m
clearly proved by the presence of the Jeffe
away, it will not be unreasonable to believ
The altitude of the ledge is the same with

The disposition of the large blocks up
acres of surface are covered by them f
approach a ledge it is easy to see what fi
action, as the projections match the inde
represents the extreme amount of removal,
covered by the large angular blocks, is qu
is fair to conclude that the transportation h
by frost. The latter agency, however,
both ledges and boulders in post glacial ti
fragments and the fractured boulders for
over the whole upper cone of the mountai

From these facts the following conclus

1. The glacial ice completely covered

THE HERMIT THRUSH.

(*Turdus Pallasii.*)

Those who have traversed our American forests cannot have failed t
struck with the solemn and sombre effect when passing through the dar
thickest and gloomist recesses of the woods, when the entire outside world is
by a thick wall of tall and majestic trees, where the cheerful light and wa
of the sun is forever excluded, by the thick canopy of foliage above, and w
perpetual twilight reigns. The air is moist and still, the soil damp and m
solemn and gloomy spots seem deserted by almost the entire animated w
those who love dark and sombre solitude, or the most recluse and s
who appear to shun the light of day, as a thief does the fellowship o
mankind. The impressive silence is broken by no sound save the occasional c
some forest creature far back in the deep dark aisles, or the creak of a limb
a nut, or twig, or the sigh of the breeze, save now and then the crash
branch or of one of those hoary old patriarchs of the forest, who, h
for centuries, at last surrenders to the inevitable march of time, and
crashing to the ground, there to lay in solemn grandeur until converted int
soil from which, in ages gone by, it sprang, and which had so long nourishe
Here in this solemn and solitary region, seeming "by all the world forsal
one may be not seldom startled by a clear, mellow, bell-like warble, ri
through the grand old woods, and filling all the gloomy silent recesses o
forest, with the sweetest and most enchanting music; as if some fairy being
another and brighter world, had strayed and become lost amidst these dark
seeming uncongenial regions.

Upon close scrutiny, the author of this almost heavenly music is found
the subject of this sketch. This species is one of the most lovely of our s
musicians. In habits he is singularly recluse, and loves the most gloomy an
tary recesses of the thickest woods.

Such then are the favorite haunts of this sweet little songster. It delig
these dark, damp and gloomy forests, particularly where a clear, sylvan s
ripples, overhung by thickly interlacing boughs, entwined with ivy and grape
whose mossy banks are shaded by the thick canopy of green above.

The Hermit Thrush arrives in Ohio, from the South, early in April, g
ally about the tenth of that month, and passes leisurely northward, in small
ling parties, and becomes quite numerous in Summer, but from the nature o
places it most frequents, is not so well known as the wood thrush and others
kindred. It seldom breeds south of Massachusetts, and departs from the
for the south about the first of October, it passes the winter in the southern s
appearing at that season as far north as southern Illinois, it proceeds to
extreme arctic portions of North America in Summer.

The nest of this species is always built upon the ground, and is "three i
high, and five inches in diameter, with a cavity of 3¼ inches wide and 1¾ i

May.

The song of this species is justly celebrat
few, if any, American birds can excel it.]
and terminates rather abruptly, with its highe
Some of its notes resemble the sweet, mellow
sweetest notes of the flute.

The Hermit Thrush is found in Summe
Atlantic Ocean to the Rocky Mountains,
species.

This bird makes no noise or complaint
silence; but should a hawk, eagle or other nat
with loud and clear notes of defiance, and se
away. When upon its migrations it is said ra

The Hermit Thrush is seven inches an
carpal joint is three and 84 one hundredths
and the tarsus one inch and 20 one hundred
ridge of bill is .70 inch long. The fourth qu
equal to the sixth; the tail is slightly emergin
ers, all handsomely rounded at the tips. The
olive brown, with a slight reddish shade; this
rump, upper tail coverts, and tail. The w
bright or decided a shade as the tail. The
slightly tinged with a delicate buff on the bre
entire breast are handsomely marked with sha
olive brown. The sides under the wings are
of the breast the spots are paler, and less di
breast. A whitish ring encircles the eye, and
paler color.

There appears to be a strange fascination

sweet bell-like notes in the soft twilight hours, when all nature appears t herself in a calm, mellow light, the sky is clad in robes of crimson, purpl gold, and the hum of insect life is heard from thicket and grove. to all these natural attractions is added the lovely song of this bird, ou of enjoyment seems full to overflowing. Beauty and elegance of form and ing, grace of motion, sweetness and mellowness of voice are all richly bined in this charming little bird, and when we add that it is not possesse single bad habit, but is extremely useful and beneficial to mankind, in destroyi mense quantities of noxious and injurious insects, we may well spare its lit encourage its presence in our land, for few beings contribute so much to ou piness and absolute welfare without *one bad quality* as this little bird. He d us by his beautiful music, he is graceful and sprightly in his motions, and e and elegant in form, and beautiful in color and markings.

SPRINGS—Continued.

T. A. FELCH, M. D.

The extremely high temperature of the water of many hot sprin it issues from the ground, prevents its employment for any therapeutical or c tic use. Exposure, however, to the cooling influence of the earth and atmo for a short time, will rapidly dissipate this extreme heat, and by employing s means enable one to regulate in a very satisfactory manner the temperat these naturally heated waters. This is well illustrated in many of the hot s of Wyoming Territory. One in particular on Gardner's River. Here the issues from the earth so heated that it is impossible to plunge the hand i without causing excruciating pain. From the first basin the water flows dow gentle declivity, and soon is gathered in a second basin or pool, thence to a and so on through a long series, until finally the same water, which at the fou head evolved steam and heat, attains the cool temperature of ordinary water. Between the first basin and the last, a regular decrease in the tempe of the water is obtained in each successive basin in the descending series: s here is presented direct from the laboratory of Nature, waters coming from th source, and springing forth at the same time, with all the properties which a able to give to it by the application of art.

An interesting question, and one which has often been discussed, is w or not any essential difference exists between waters which are heated artif and those heated naturally. Concerning this, Prof. Tyndall, in a note t Walton, says: "I am not acquainted with any difference between natura and artificial heat. I am not acquainted with any thermo-electric condition could cause any perceptible difference between the therapeutic action of n

the former acts in a much more benefi
may, however, not be due to any essenti
of heat, as heat, but simply to those exte
great influence upon its therapeutical act
heated water is not heated uniformly th
into the tub is decreasing in temperature,
moment from one degree of heat to anoth
the water remains of the same temper
which is met whenever we undertake t
Take, for instance, the artificially prepa
of the natural spring water may be accu
to ascertain, and also their relative quan
may all be laid before him, and their solu
the best approved methods, and still the
from the natural compound. Why this
bility of ascertaining by chemical means
substance which may have a great infl
upon the presence of some substance
peculiar combination of the known ingr

In certain diseased conditions of th
the action of some mineral waters prod
by the then known action of the ingred
discovered arsenic as one of the substa
plain that to this article was due the ben
fact may remain at the present time;
known substances, and even of bringi
ascertain the true source and cause of
springs, which to-day surprise us by th
rapid is the advancement of science, a

Baden and Aix la Chapelle are to Europe—a popular resort for all of invalids, and a center of social life. There are many springs in the l and older portions of our vast territory, whose medicinal properties hav well proven, and whose curative agencies are well known.

At the present time the thermal springs on this continent which almos pletely monopolize attention, are those situated in the States of Arkans Virginia. The former, known as the Hot Springs of Arkansas, are situated Southwestern part of the State, on the Western slope of the Hot Springs Mo a spur of the Ozark Range, and are at an elevation above the level of t of 1,400 feet. The individual springs number in all fifty-six. Analysis sho they are all closely allied as regards the quality of their constituents, thoug differ materially in the quantity of such ingredients, and in their temperature. variety forms a very important element in the application of these waters treatment of disease, as it is often found that though benefit in a particula may not be derived from the water of one spring, that of its near neighbor n in the most happy manner. Their temperature ranges from 93° to 150° I they discharge collectively 334 gallons of water every minute. The followin analysis as given by Prof. David D. Owen.

One and one-half (1½) gallons of water contain:

Silica, with Sulphate of Lime,	
Carb. of Lime, 1.68, and with Bi-carb. of Lime,	
Carbonate of Magnesia,	
Bi-Carbonate of Magnesia,	
Sulphate of Lime, dissolved in water,	
Chloride of Potash,	
Chloride of Sodium,	
Oxide of Iron, with a little Alumina,	
Dry powder (unsol.),	

Besides the above ingredients, it is claimed that some of the springs c Carbonate of Lithia, Oxide of Manganese, Arsenite of Lime, Arsenite of Bromine, Iodine (a trace), Organic matter (a trace).

A confervoid growth is formed on the surface of the water, which a externally to diseased parts, is much used, though no particular medicinal p ties can be ascribed to it. The chief therapeutical action of these waters posed to be owing almost entirely to their elevated temperature, and it is form of baths that they are mainly used. The native inhabitants of this c were undoubtedly acquainted with these springs and their efficacy in d for it is said that Sir Walter Raleigh, upon his first arrival in Virginia, "hear the red man of the great springs beyond the 'Father of Waters,' and o wondrous efficacy in the cure of disease, and so reported to Queen Elizabe report being still on file in the British Admiralty Office." The wonderful told to Ponce de Leon concerning the "Fountains of Youth," and which s the foolish old man to undertake the perilous journey for their discovery, and

resulted in disappointment, really had a foundation in fact, the
however, highly tinged and exaggerated in the vivid imagination
stitious Indians. These spring waters have in many cases
such a wonderful influence over disease that invalids throng there
of the world. Consequently, artificial advantages have been
already furnished by nature—hotels, improved apparatus, the
physicians, etc.—until it has undoubtedly now become the
United States. The water is clear, tasteless, inodorous, and free
gases. "They are more nearly allied to Gastein, in the Noric
known springs." But this wonderful region, comprised within a
not furnish hot and thermal springs only, but also quite a
springs, which possess valuable mineral properties, and may be
used in connection with the hot water. As long ago as the time
country was in possession of the Indians, the grounds occupied
were regarded by them as neutral. A recent decision of the
that the United States are the owners of that section of the c
posed that the Government establish there a sanitarium, at which
may receive the benefit of the waters at the National expense.

As the country comprising what is known as the Western States
becomes developed and settled, attention is quickly called to their
tages; consequently we find that in California, Colorado and Oregon,
of Wyoming, New Mexico and Nevada, there exist an almost
most excellent thermal springs, whose great properties are just
developed. Among those in California, may be mentioned the
county. They are about sixty in number, with a temperature
to 195° F. "About five miles Southwest of Calistoga is the
object of exceeding interest to the geologist or tourist. There are
trate remains of a vast forest of gigantic trees, similar to the t
the Pacific coast, all converted into solid stone. It is supposed to
volcanic agency, the surface having been deluged with hot
waters."—*Walton.*

Here are found entire trees, 300 to 400 feet long, all turned to
stumps and gigantic limbs lie scattered upon the ground in
The Geysers, Sonoma county, present a large variety, which are
dicated by the names given to individual members of the group, as
Iron Spring," "Medicated Geyser Bath," "Boiling Alum and S
"Epsom Salts Springs." Near the hotel, in Pluton Canon, is the "
Sweetened with sugar, it makes a palatable lemonade. In Santa
are situated the Santa Barbara Hot Sulphur Springs. These
doubt, valuable properties, and will form an excellent adjuvant to
measures employed in certain diseased condition. This section of
within the last few years, become a favorite resort for a certain
The temperature is remarkably even, being subject to

tions throughout the year, and it is a matter of fact known and acted up physicians, that certain invalids may here enjoy more comfort, and possibl longed life, than under any other and changed conditions they could hope fc is a general remark, which may be applied to nearly the entire State, that from the climatic advantages, all nature seems to assist in imparting health invalid. The natural scenery is surpassed by none other in the world, a natural products attain a development, and exist in a profusion, nowher witnessed.

There are numerous other thermal springs throughout the State, whic not necessary to mention, as the above list will suffice to indicate their g character.

In Colorado, among others, there are the Idaho Hot Springs, Clear county, having a temperature of from 85° to 115° F. They are said to re in many respects the celebrated waters of Carlsbad, in Bohemia. We wi mention Middle Park Hot Sulphur Springs, Summit county, with a tempera from° 111 to 116° F.

The climate of Colorado is most excellent in many respects, and as springs are situated high up on the mountains the scenery and other adva are said to be all that could be desired.

As regards the hot springs of Wyoming, Nevada and New Mexico thei ber and character can be judged of by the account given in a previous art this series. At present few individual ones can be mentioned, since so l known of their constituents, and they are not surrounded by those artificial tages necessary to constitute popular watering places.

The Lebanon Springs, Columbia county, New York, is known as th thermal spring in New York or the Eastern States, and their temperature about 73° F.

In North Carolina we find the Warm Springs, Madison county. The ' ing springs" have a temperature of 102° F., and the "drinking sprin 97° F.

The best known and most popular of the thermal springs in the Easte of our Continent are those located in Virginia, Bath county.

The following analysis by Prof. Gilham will show the general comb of their ingredients:

One pint contains:

Carbonate of Magnesia,	
Carbonate of Iron (protoxide),	
Carbonate of Lime,	
Chloride of Potassium,	
Chloride of Sodium,	
Sulphate of Potassa,	
Sulphate of Soda,	
Sulphate of Magnesia,	
Sulphate of Lime,	
Silica,	

The mineral constituents exist in very small quantities, and like r thermal waters they owe their efficacy to the elevated temperature alo temperature ranges from 78° to 110° F. The artificial improvements at t are very complete, and every convenience possible provided for the comf valids.

It is thus seen from the above wherein lies the advantages in a ther point of view of the thermal over the cold mineral waters. Their bene ployment is limited almost entirely to the bath, though at some of the sp use of copious draughts of the warm water is regarded as a valuable adju is hardly necessary to say that these waters are not applicable to all form ease, that in fact there are many cases in which they would be positively i and that they should never be employed except under the advice and dir intelligent and competent persons.

The thermal springs in Europe are not very numerous, still they world-wide reputation and possess mineral ingredients which will alwa them to high a place as remedial agents. The waters of Vichy, Fran of the most celebrated, and we annex the analysis as given by Bouquet

One pint contains:

Carbonate of Potassa,	
Carbonate of Soda,	
Carbonate of Magnesia,	
Carbonate of Iron,	
Carbonate of Maganese,	
Carbonate of Lime,	
Carbonate of Strontia,	
Arseniate of Soda,	
Chloride of Sodium,	
Phosphate of Soda,	
Sulphate of Soda,	
Borate of Soda,	
Silica,	
Gases.	
Carbonic Acid,	

The temperature is about 106° F.

There are nine springs, and they vary considerably in temperature, not in chemical constitution.

Weisbaden in Germany has a temperature of nearly 156° F., and France, of 149° F.

Aix la Chapelle, Rhenish Prussia, a very noted place, has its water 131° F.

Aix le Bains, Savoy, 111° F.

Bagneres de Suchon, France, 131° F.

Carlsbad, Bohemia, 162° F.

Gastein, Austria, 87° to 160° F.

Toplitz, Bohemia, 120° F.

Such then is a very brief summary of the most noted thermal springs c own and foreign countries. Thus has the Creator stored up in the bowels c earth a never ending supply of remedial and health giving agents for the u his creatures.

It will be seen that the temperature is considerably below the highest ten of our Western springs. In the vicinity of active volcanoes water is f springs heated to the boiling point. But these tables comprise only at considerable distances from active volcanoes, and show clea extent they comply with the rules governing the transmission of h waters mentioned in the first part of this article.

Most of these springs existed in their present condition as long ago a any authentic history, and it is probable that in those days of superst and the tendency to attribute to supernatural agencies every event w first seemed inexplicable, that they then enjoyed a higher popularity than he present time. And to us it is curious to notice the feelings with whic possessing remedial qualities were regarded by the superstitious n the "dark ages." That feeling which induced them to call the spring name of some good and holy saint, to imagine the water inhabited by d ies, and to attribute to the influences of these personages the good effects c water.

And this superstition, or perhaps it might more properly be called custo still sometimes met with. Pennant says, speaking of St. Winifred, that "in mer a few are to be seen in the water in deep devotion, up to their chins for h sending up their prayers." (*Benedicite.*)

We acknowledge our indebtedness for many of the above facts and figu that excellent work of Dr. Walton entitled "Mineral Springs of the United S and Canada."

(*To be Continued.*)

THE ACTION OF RIVERS AS AGENTS IN MODIFYING SURFACE OF THE EARTH.

Running water produces very great and remarkable changes upon the su of the earth, evidenced in the deep ravines, gorges, canons and stupendous racts, so profusely scattered throughout the World. This powerful action of is effected by erosion, in wearing away and transporting the disintegrated m als. The problem of the canons, those mighty chasms, through which flo streams of our western territory, beautifully display this powerful action of w and exhibit the working of erosion in a marked degree. Prof. G. K. Gi thus treats upon this interesting subject:

The deep gorges which so facilitate the examination of the strata and of displacements, are themselves of interest as monuments of erosion. To ac

better demonstrate its radical value th
case. For this purpose it is necessa
cesses of erosion and of the conditio
so complex that this cannot be done l
portant factors, and in undertaking it
or slighting all considerations which
lem in question.

In order to analyse sub-aerial erc
of parts, and (B) as modified by cor

A. All indurated rocks and m
cohesion, which must be overcome
The natural processes by which the c
up erosion. They are called disinteg

Transportation is chiefly perform

Disintegration is naturally divide
plished by running water is called
weathering.

Stated in their natural order, th
erosion, are (1) *weathering*, (2) *transp*
general surface of the land are disin
loosened is *transported* by streams to
helps to *corrade* from the channels of
be transported to the same goal.

(1.) In weathering the chief age
temperature, the beating of rain, and

The great solvent of rocks is wa
stances, of which it becomes the vehi
of the formation and decomposition
tegrated by their complete solution, b

(2.) A portion of the water of rains flows over the surface and is qu gathered into streams. A second portion is absorbed by the earth or roc which it falls, and after a slow underground circulation reissues in springs. transport the products of weathering, the latter carrying dissolved minerals, the former chiefly undissolved.

Transportation is also performed by currents of air, and by the direct a gravity; but in the present discussion it will not be necessary to consider t agents.

(3.) In corrasion the agents of disintegration are solution and mecha Whenever the two are combined, the superior efficiency of the latt and in all fields of rapid corrasion the part played by solution is so s t may be disregarded.

The mechanical wear of streams is performed by the aid of hard mineral which are carried along by the current. The effective force is that of the tools are mud, sand and bowlders. The most important of the it is chiefly by the impact and friction of grains of sand that the rocky streams are disintegrated.

Streams of clear water corrade their beds by solution. Muddy stream partly by solution, but chiefly by attrition.

Streams transport the combined products of corrasion and weathering. part of the debris is carried in solution, and a part mechanically. The fine the undissolved detritus is held in suspension; the coarsest is rolled along the om; and there is a gradation between the two modes. There is a constant minution of all the material as it moves, and the work of transportation is the accelerated. Bowlders and pebbles, while they wear the stream-bed by poun and rubbing, are worn still more rapidly themselves. Sand grains are worn broken by the continued jostling, and their fragments join the suspended l Finally the detritus is all more or less dissolved by the water, the finest the rapidly.

In brief, (1) weathering is performed by solution; by change of tempera including frost; by rain beating; and by vegetation.

(2) Transportation is performed chiefly by running Water.

(3) Corrasion is performed by solution, and by mechanical wear.

Corrasion is distinguished from weathering chiefly by including mecha wear among its agencies, and the importance of the distinction will be appa when we come to consider how greatly and peculiarly this agency is affecte modifying conditions.

In the region of canons, the progress of corrasion has outstripped tha weathering, and to discover what conditions have determined this result, solve the problem of the canons.

B. The chief conditions which affect the rapidity of erosion are (1) decli (2) character of rock, and (3) climate.

(1.) In general, *erosion is most rapid where the slope is steepest;* but weathe transportation and corrasion are affected in different ways and in different deg

increases, but the blows acquire greater force from the greater size of the moving fragm distinguish the ability to corrade from the r further on to depend largely on other conditi

Weathering is not directly influenced by through transportation. Solution and frost, both retarded by the excessive accumulation ceases altogether at a few feet below the surfa as the zone of its activity descends and t becomes more sluggish. Hence the rapid r ing stimulates its action, and especially that upon frost. If, however, the power of tran completely the products of weathering, the checked; for the soil, which weathering ten catch rain as it reaches the earth, and store frost, instead of letting it run off at once un

In brief, a steep declivity favors transpo The rapid, but partial, transportation of wea but the complete removal of its products ret

(2.) Other things being equal, *erosion i least resistance;* but the rocks which are most cess of erosion, do not necessarily stand in t integration by solution depends in large part proceeds most rapidly with those fragmental and of which the texture is open. Disinteg which absorb a large percentage of water a tion by mechanical wear is most rapid in favored by those rocks which yield by disint debris.

ınd by its distribution through the year. All are accelerated by its incre
by its diminution. When it is concentrated in one part of the
expense of the remainder, transportation and corrasion are accelerat
weathering is retarded.

Weathering is favored by abundance of moisture. Frost accomplish
the rocks are saturated; and solution, when there is the freest subte
But when the annual rainfall is concentrated into a limited
ı larger share of water fails to penetrate, and the gain from temporary floodi
not compensate for the checking of all solution by a long dry season.

Transportation is favored by increasing water supply as greatly
declivity. * When the volume of a stream increases, it becomes
same time more rapid, and its transporting capacity gains by the increm
velocity as well as by the increment to volume. Hence the increase in p
ransportation is more than proportional to the increase of volume.

It is due to this fact chiefly, that the transportation of a stream which
:o floods is greater than it would be if its total water supply were eve
ıributed in time.

The indirect influence of rainfall and temperature, by means of veg
ıas different laws. Vegetation is intimately related to water supply. T
little or none where the annual precipitation is small, and it is profuse wh
latter is great and especially where the temperature is at the same time hig
proportion as vegetation is profuse the solvent power of percolating w
increased, and, on the other hand, the ground is sheltered from the mec
action of rains and rills. The removal of disintegrated rock is greatly i
by the conservative power of roots and fallen leaves, and a soil is invariab
seved. Transportation is retarded. Weathering by solution is accelerated
a certain point, but in the end it suffers by the clogging of transportation
work of frost is nearly stopped as soon as the depth of soil exceeds the l
frost action. The force of rain-drops is expended on foliage. Moreover
soil acts as a distributing reservoir for the water of rains, and tends to e
the flow of streams.

Hence the general effect of vegetation is to retard erosion; and sin
direct effect of great rainfall is the acceleration of erosion, it results that it
and indirect tendencies are in opposite directions.

In arid regions of which the declivities are sufficient to give th
drainage, the absence of vegetation is accompanied by absence of soil. \
shower falls, nearly all the water runs off from the bare rock, and the litt
is absorbed is rapidly reduced by evaporation. Solution becomes a slow
for lack of a continuous supply of water, and frost accomplishes its wor
when it closely follows the infrequent rain. Thus weathering is retarde
transportation has its work so concentrated by the quick gathering of s
into floods, as to compensate, in part at least, for the smallness of the tot
fall from which they derive their power.

climate is balanced by a more rapid transportatio
climate, and in which the rate of degradation att

Having examined the conditions of erosion s
in such combination as will help to an understan

Over nearly the whole of the earth's surfac
this exists we know that the conditions are mor
transportation. Hence it is true in general that t
portation are those which limit the general degra

To understand the manner in which this li
look at the process by which the work is accomp

Transportation and Comminution.—A stream
expends an amount of energy that is measured b
vertical distance through which it descends. I
water upon its channel, the velocity of the cur
but if, as is the usual case, there is no increase o
energy is consumed in friction. The friction pro
of the water, and especially induces subsidiary c
the general onward movement. Some of the
upward tendency, and by them is performed t
They lift small particles from the bottom and hol
move forward with the general current. The f
and are carried farthest before they fall. Larg
dropped at once. Still larger are only half lifte
side of the current and rolled over, without q
there is a limit to the power of every current, an
are not moved at all.

There is a definite relation between the velo
the largest boulder it will roll. It has been sho
the boulder is proportioned to the sixth power of

stream to be of uniform particles, then the measure of the energy their transportation, is their total weight multiplied by the distance would sink in the time occupied in their transportation. Since fine more slowly than coarse, the same consumption of energy will con load of fine than of coarse.

Again, the energy of a clear stream is entirely consumed in friction tom; and the friction bears a direct relation to its velocity. But i added to the water, then a portion of its energy is diverted to the t of the load; and this is done at the expense of the friction upon the hence at the expense of velocity. As the energy expended in tr increases, the velocity diminishes. If the detritus be composed of ticles, then we may also say that as the load increases, the velocity But the dimishing velocity will finally reach a point at which it can port particles of the given size, and when this point is attained, the str maximum load of detritus of the given size. But fine detritus require city for its transportation than coarse, and will not so soon reduce the the limit of its efficiency. A greater per cent. of the total energy of can hence be employed by fine detritus than by coarse.

Thus the capacity of a stream for transportation is enhanced by co in two ways. Fine detritus, on the one hand, consumes less energy for portation of the same weight, and on the other, it can utilize a greater the stream's energy.

It follows, as a corollary, that the velocity of a fully loaded stream (*ceterias paribus*) on the comminution of the material of the load. When has its maximum load of fine detritus, its velocity will be less than when its maximum load of coarse detritus; and the greater load corresponds t velocity.

It follows also that a stream which is supplied with heterogeneous d select the finest. If the finest is sufficient in quantity, the current w checked by it, that the coarser cannot be moved. If the finest is not s the next grade will be taken, and so on.

Transportation and Declivity.—To consider now the relation of dec transportation we will assume all other conditions to be constant. Let us that two streams have the same length, the same quantity of water, flow ov of the same character, and are supplied to their full capacities with detritus same kind; but differ in the total amount of fall. Their declivities, or r fall, are proportional to their falls. Since the energy of a stream is measu the product of its volume and its fall, the relative energies of the two strea proportional to their falls, and hence, proportional to their declivities. Th cities of the two streams, depending as we have seen above, on the chara the detritus which loads them, are the same; and hence the same amo energy is consumed by each in friction on its bed. And since the energy

ple ratio.

[There are two elements of which no ac
cussion, but which need to be mentioned t
they detract in no way from the conclusions.

The first is the addition which the trans
of the stream. A stream of water charged
and an unstable fluid. It has been treated n
a constant expenditure of energy to maintain
a compound fluid, it is plain that the energy
than the energy pertaining to the water alone
the mixture to the mass of the simple water.

The second element is the addition whi
of the stream. The co-efficient of friction of
will always be greater than that of the simpl
same velocity a greater amount of energy wil

It may be noted in passing, that the ene
of the detritus on the stream bed, accomplish
corrasion of the bed.]

Transportation and quantity of water.—T
depends on the character of the bed, on the
on the velocity of the current. When the otl
varies directly with the area of contact. T
length and form of the channel, and on the
the same length, and same form of cross-sect
tion, the area of contact varies directly as the
Hence, *celeris paribus*, the friction of a strean
square root of the quantity of water. But, a
stream is proportioned directly to the quar
energy is equal to the energy spent in friction.
tion. Whence it hat if a stream

It is noteworthy also, that the obstruction which vegetation opposes tc portation, is especially effective in that it is applied at the infinitesimal sou streams, where the force of running water is least.

A stream which can transport debris of a given size may be said to be *tent* to such debris. Since the maximum particles which streams are able t are proportioned to the sixth powers of their velocities, competence depe velocity. Velocity, in turn, depends on declivity and volume, and (inv on load.

In brief, the capacity of a stream for transportation is greater for fine than for coarse.

Its capacity for the transportation of a given kind of debris is enlarged i than simple ratio by increase of declivity; and it is enlarged in more than ratio by increase of volume.

The competence of a stream for the transport of debris of given fine limited by a correspondent velocity.

The *rate* of transportation of debris of a given fineness, may equal the city of the transporting stream, or it may be less. When it is less, it is from the insufficiency of supply. The supply which is furnished by weathe never available unless the degree of fineness of the debris brings it within th petence of the stream at the point of supply.

The chief point of supply is at the very head of the flowing water. rain which falls on material that has been disintegrated by weathering, begin it has saturated the immediate surface, to flow off. But forms a very thin its friction is great; its velocity is small; and it is competent to pick u particles of exceeding fineness. If the material is heterogeneous, it dis ates and leaves the coarser particles. As the sheet moves on, it becomes and soon begins to gather itself into rills. As the deepening and concentra water progresses, either its *capacity* increases or the load of fine particles mented; or, if fine particles are not in sufficient force, its *competence* increas larger ones are lifted. In either case the load is augmented, and, as rill joi rill, it steadily grows, until the accumulated water finally passes beyond th of disintegrated material.

The particles which the feeble initial currents are not competent to have to wait either until they are subdivided by the agencies of weather until the deepening of the channel of the rills so far increases the dec that the currents acquire the requisite velocity, or until some fiercer storm the ground with a deeper sheet of water.

Thus the rate of transportation, as well as capacity for transportation vored by fineness of debris, by declivity, and by quantity of water. It is o chiefly by vegetation, which holds together that which is loosened by weath and shields it from the agent of transportation in the very place where that is weakest.

When the current of a stream gradually diminishes in its course example, in approaching the ocean—the capacity for transportation also

The rapidity of mechanical corrasion depends or
ber of transient fragments, on the hardness of the ro
of the stream. The blows which the moving fragme
are hard, in proportion as the fragments are large and
are most effective when the fragments are hard and
number is increased, up to a certain limit, by the
stream; but when the fragments become greatly
a stream, their force is partially spent among thems
the same degree protected. For this reason, and bec
retardation of current, it is probable that the maximu
formed when the load is far within the transporting c

The element of velocity is of double importar
only the speed, but, to a great extent, the size of
rocks. The co-efficients upon which it in turn dep
quantity of water, have the same importance in corra
portation.

Let us now direct our attention to the region of

The plateau province lay beneath the ocean up t
age. In early Cenozoic time it was nearly covered b
not greatly elevated.

In more recent epochs it has been very greatly,
lakes have been drained. The erosion which began
above the ocean, and extended its area as the lakes
continually to the present time. The average total upl
the mean altitude of the present surface is about 7,
is the mean amount of degradation. While 5,000 fe
the general surface, an amount greater by several tho
by the rivers.

The greater tributaries of the Colorado have thei

of the uplift. It is favored by a moderate supply of debris, always
:or the work of excavation, but not so great as to consume the entire en
the current.

The contrast between the degradation of the upland and the cutting o
ways is strongest where the rocks are best fitted to resist disintegra
rivers sink their channels into the land in a harmonious and interdeper
and cannot excavate soft beds more deeply than hard. But the only d
imit to the degradation of the tables is the level of the draining river sys
he varying retardation which it suffers from the resistance of different r
xpressed in the varying height of the canon walls.

A second problem which has arisen in the study of the erosion of the
eaus may be called

THE PROBLEM OF WATERFALLS.

Where rivers descend a slope that is terraced by the alternation of hard
strata, they are apt to leap from the edges of the hard beds in water
he Colorado, notwithstanding the structure of its bed, presents the mos
conditions, makes no leap. At the head of Marble Canon, for inst
river crosses a great bed of limestone, lying nearly level and underlaid
reat bed of friable sandstone. The limestone resists all erosive agents as str
s does the Niagara limestone, and the sandstone yields to them as easily as
he Niagara shale. But, instead of plunging from one to the other in a great
uract, the Colorado cuts the two with nearly equal grade of channel.
average descent in the hard rock is ten feet to the mile, and in the soft less
five feet.

It is evident that for the production of waterfalls some condition is inv
beside that of the constitution of the rock system which the stream traverse
some condition that pertains to the constitution of the stream itself. Such a
dition is to be found in the relation of corrasion to transportation.

Let us suppose that a stream, endowed with a constant supply of water,
some point continuously supplied with as great a load as it is capable of carr
For so great a distance as its velocity remains the same, it will neither corrad
deposit, but will leave the grade of its bed unchanged. But if in its progr
reaches a place where a less declivity of bed gives a diminished velocity, it
pacity for transportation will become less than the load, and part of the load
be deposited. Or if in its progress it reaches a place where a greater declivi
bed gives an increased velocity, the capacity for transportation will become gr
than the load, and there will be corrasion of the bed. In this way a str
which has a supply of debris equal to its capacity, tends to build up
gentler slopes of its bed and cut away the steeper. It tends to establish a si
uniform grade.

Let us now suppose that the stream, after having obliterated all the ine
ties of the grade of the bed, loses nearly the whole of its load. Its velocity
once accelerated and corrasion begins through its whole length. Since the st

as there is inequality of grade, there is ineq
pacity for corrasion; and where hard rock
capacity for corrasion will be increased. T
capacity for corrasion is everywhere proport
—that is, until there is an equilibrium of ac

In general, we may say that a stream t
its course. Its power inheres in its fall, an
When its work is to corrade and the resi
energy where the resistance is great, by c
small space; and diffuses it, where the resist
in a long distance. When its work is to tr
the fall is evenly distributed by a uniform
transportation and corrasion, as is the usual
and the inequality is greatest when the load

The condition of the Colorado in resp
the Niagara and that of the Platte.

The water of the Niagara is nearly de
the outlet gathers the detritus of all tributar
a great storm yields a small portion of it to
tion is at a minimum, and the differentiatio
reaches its maximum in a cataract.

The water of the Platte is supplied v
Powell, who has made a careful study of th
to the fact that it flows through a region of
clivity is as great as that of the Colorado, a
posing depth, if only the material of its ba
in walls. As it is, the loose sands of the b
into the river, and, its energy being consum
of its channel can proceed no faster than

HARDENING AND TEMPERING GLASS.

The well-known Dresden manufacturer Herr F. Siemens, has rec patented a method of hardening, tempering and pressing glass, which ap likely to become of more practical utility than the process of hardening glas covered by M. de la Bastie. At the time when the latter's discovery was public, it was announced that Herr Siemens and others had been experime in a similar direction, and the accusation was freely made that Bastie's pr was being pirated. Whether or not it is so in Germany, the process describ Herr Siemens in his English specifications, certainly keeps clear of the "el put forward by Bastie, for he does not employ the mothod of hardening gla plunging it when heated into a liquid bath at a lower temperature, but ha the glass by placing it in moulds and pressing it at the same time. It obvious at the time when M. Bastie's process was made public that great, i insuperable difficulty would be experienced in getting the glass to retain its s during the hardening operations, especially so with articles that required t shapely, to be of any value at all.

Whether these difficulties have been overcome we are not informed, a there are already several patents relating to hardened or so-called unbrea glass in the field, unless M. de la Bastie speedily occupies a position in the ket, he may find himself forstalled. At any rate it is asserted that the pr patented by Herr Siemens effects all that could be done by M. de la Bastie's more, for the shape of the articles can be easily preserved uninjured. It co in a method of heating and then suddenly cooling the glass to be hardened o pered; but when the articles are such as are usually moulded, the hardening tempering are accomplished at the same time as the pressing—*e. g.*, the molten is run into suitable moulds, and while still highly heated is squeezed, the m having the effect of giving the necessary cooling without resorting to the l bath of M. Bastie. The materials employed for the moulds depends o nature and thickness of the glass; in cases where the cooling process must n sarily be a rapid one, metals of good conducting power, such as copper are ferred, while in those where the cooling has to be effected more gradually, m of earthenware, or other bad conductors of heat are employed.

In cases where the glass articles to be operated upon vary in thickness conductivity of the parts of the moulds is varied accordingly, either by th metal near the thicker parts of the glass, or by making those parts of the mo a better conducting material than the parts next the thinner portions of the The moulds, too, must be kept at a certain temperatures, varying according nature of the glass requires that they should be cooled to a greater or less de In ordinary practice, however, it is found that cast-iron moulds maintained a temperature of boiling water or thereabouts, and earthenware moulds kept cool, yield very satisfactory results. The liquid glass may be conveyed into the moulds, or may be taken from the melting-furnace on the blower's

and shaped in the mould, but it is preferable to heat the
or partially shaping, before pressing and cooling them. This part
introduces the difficulty of keeping the articles in shape, and it
Herr Siemens by means of casings or shells of platinum, such
ferred to the mould with the glass to undergo the pressing and
The heating oven may be of any suitable construction, but Herr
to employ regenerative gas muffle ovens, heated under the
crowns by the flames of gas and air, which pass from one set of
another, which latter, becoming sufficiently heated, the currents
the well-known manner of alternated working. The muffle
closed in, the articles are protected from dust and other
open furnace are apt to settle on and damage the surface of the
halves of moulds are mounted on trucks or hand-carriages, and
furnace mouth, or the oven, as the case may be, and, having
are run under the respective upper halves, which may be loaded
sired pressure. The temperature of the moulds is kept at the
supplying them with liquid, and water at the boiling point is
ed for the purpose. Herr Siemens claims the process described
pressed glass, by treating it while heated in moulds of a lower
by it is simultaneously compressed and hardened. He also
moulds having parts of varying thickness, or of different
degrees of conductivity. A separate claim is also made for the
num moulds to maintain the articles in shape whilst being
There is no question but that a large demand will arise for
soon as it can be supplied.—*Van Nostrands, in American Builder.*

THE CATALPA.

This showy and beautiful tree is one of those semi-tropical
have so long been prized as adornments of our homes and parks
glossy leaves and beautiful display of foliage justly entitle it to
the most elegant of our forest trees.

The C. Syringifolia is indigenous in the Southern
States, but is also a native af Illinois, Indiana, and portions of
silver gray, slightly furrowed; the leaves are large and heart-sl
tinged with violet, and dotted with purple and violet in the throat;
succeeded by pods about twelve inches long, which hang until
spring. The Catalpa often grows in its natural state to a height
with a trunk from 18 to 24 inches in diameter. In the New
dles to a mere shrub, and is very tender and liable to be killed
may be propagated by seeds or by cuttings from the root. It

20 feet in 10 years, when it begins to blossom. The calyx is two parted, (bell shaped, five stamens, two only of which are fertile.

Seeds thin, flat, enveloped in a long, narrow membraneous wing, termi by a hairy tuft; "each seed with its wing is about an inch long, and a line half broad," flowers in clusters. The wood is durable, of fine texture, ligh susceptable of a delicate polish. Its color is grayish white. Posts of the C wood last for a long time, even when exposed to dampness.

If a portion of the cellular integuments of this tree is removed in the of the year, a poisonous and offensive odor is exhaled. The bark is said t stimulant, tonic, and antisceptic in its qualities. The honey from the flowers said to be poisonous. The Catalpa is used in cabinet making, and for oth poses where a fine polish is required, together with durability. In some (has been used for railroad ties, but the scarcity of the tree prohibits its g adoption for this purpose. In some localities in Ohio and Indiana, where fo quite abundant, it has now become nearly extinct. Like almost all our trees, it is quite common in some portions of the country, and rare, or unknown, in other, and apparently equally as favorable localities.

Perhaps few trees are so well adapted for ornamental purposes as the C its broad, spreading head, and glossy leaves, while, intermingled among th green foliage, are clustered the beautiful white pendant flowers like im drops of pearls set in a sea of green, if to this is added the silvery white and symmetrical shape of the tree itself, it may well be prized as a fit and l ful adornment for the park or grounds of the wealthy, or adornment to the of a city For this purpose it is much used in all our cities and in Europ growth should be fostered and encouraged, for aside from the above qualit fine grained and durable wood justly render it a much prized and valuable tion to the list of indigenous productions of our forests. The trunk ger grows to the height of ten feet before any branches are developed straigl smooth, gradually tapering and becoming smaller, until it terminates in its spreading head. Trees having a trunk upwards of four feet in diameter a uncommon in old forests. The rate of growth of this tree is quite rapid. appearance of this species when devoid of foliage is scragged and ung The catalpa is especially numerous upon the bottom lands of the rivers Southern States, especially in Georgia, Florida, Alabama, and Mississippi.

Prof. Cox, in his geological report, mentions Catalpa trees in Gibson c Indiana, of nine to twelve feet in circumference. In Knox county, same trees of from two and-a-half to three feet in diameter were common; on measured, four and-a-half feet in diameter. In the same county a tree stanced as measuring four feet in diameter. A tree in Posey county me 130 feet high and four feet in diameter.

That the Catalpa is indigenous, and not artificially introduced into ou ests, is proved by the fact that the early settlers found it abundant in the m the primitive forests.

insects we may easily discover the import
of nature; and history itself proves that a
tions to each other is sure to be followed b
becomes of the deepest importance, not al
who has either business or patriotic intere
self, establishes a wholesome balance am
no more of one species than will be kep
only leave them alone, this beautiful and h
there is an insect which feeds upon a cert
stroys the insect. But kill the bird and
plant; it is because man has destroyed th
come a pest, and they will cease to troubl
store the balance of which nature shows
to be totally destroyed or condemned as
the fulfillment of some good end; and th
of any other class of animal life; none a
only when they are stimulated to excessiv
Before passing judgment upon them we r
most intricate and delicate silken struct
strangest and most romantic incident.
sweetest of nature's productions, the air
kept pure and wholesome by the agenc
draw sustenance from the impurities of th
are to be exterminated, even if it were po

The reproductive powers of insect
a single pair of grain weevils have proc
August. The common varieties of aphi
almost all kinds of plants, are produced
fore; and through the summer only female

me of the Gallinacae lay from six to twenty eggs to a brood, yet th
e vast increase of insects, and to keep these little pests in ch
ould be spared and protected. If the number of eggs produce
onderful the number of insects eggs and larvæ destroyed by birds i
erful. Audubon says that a woodcock will eat its own weight of i
le night. Woodpeckers are constantly employed in ridding the o
ects and their eggs, which they skillfully discover under the pieces
Robins are constantly hunting for worms and grubs, which they fi
nder the surface of the ground. The swallow, martin and night-h
inually catching and devouring immense quantities of insects. T
excessive increase of insects is evidently the great task which birds
to perform. Did birds have no other office save to cheer and encoura
with their beautiful plumage and song, and to typify a purer and more
istence to us creatures who grovel here below, even then they
serve the favor of every Christian and every poet; but when the us
bined with the beautiful, and a practical value is added to an elevati
they commend the interest of everyone.

ANCIENT GRECIAN GLASS.

Among the rare objects discovered in ancient Grecian burial place
curious ones of glass, mostly found in the graves of women. Freque
consist of vessels with long necks, drinking vessels, (without handles,
at the bottom) and flat and open dishes. All these glass objects appe
been articles of luxury, and not domestic utensils. According to the
vestigations of Professor Lanterer's, in Athens, this glass is usually a
soda, and sometimes of potassa; but it is always very rich in lead oxid
wonderful ancient productions often show the most magnificent rainbo
with a metallic lustre like polished gold and silver, and the material of wh
are formed may be split up into very thin layers. That this peculiar app
is the result of old age, which has produced a change in the material, may
in the glass vessels preserved in the Metropolitan Museum of Art, in N
City, which are of still older date, having been procured from the Island o
by General Di Cesnola.

These objects belong to a period of time intermediate between the
Egyptian and the Grecian periods; and the coloring operation is the same
which takes place on the surface of glass panes in windows exposed to con
changes in moisture and dryness. But it is found in its most complete
when, in the course of centuries, the action of time penetrates the whole
forming layer upon layer. Shining with the colors of soap bubbles or mot
pearl, but with much greater intensity. Among the rarely occurring obje
some of a deep green or black-brown color, which are called vulcanic glass

are made of obsidian; but to these the ancients added oxide of
of massicot, so as to make the mass more easily fusible.

Colored glasses have also been found in the ancient Greciar
yellow colored (which, however, had become almost opaque)
of alumina colored with oxide of iron; probably ocher was used
with the pulverized glass before the melting, so that the color
the fusion. A blue glass, which contained streaks of blue of
tained oxide of copper; and in producing this effect the
the malachite and azurite, (both mineral carbonates of copper)
blue colored copper ores, or the so-called *caeruleum*, which in
copper, sand and salt, and was used to color the cases in which
preserved.

A specimen of white glass, resembling opal, but
cracks, was undoubtedly made of milky half opal, which is fc
the island of Mylos, and which was fused to make objects of the
appearance.

These and other modern investigations continue to prove
lost arts of the ancients which some persons grossly exaggerate,
appear that the ancients surpassed the moderns in knowledge and
not amount to more than laborious attempts to produce a few of
which modern industry produces with the greatest ease, and in
ance, placing them, for reason of their low price, at the
trous man, even of the comparatively poor laborer, who, thanks
genius of the present day, enjoys comforts which the work
Greece would never think himself worthy to enjoy.—*Scientific*

THE LIFTING POWER OF BIRDS.

The lifting power of the large birds of prey is enormous.
white-headed eagle are strong enough to break a man's leg
and the bird can mount into the air as easy as a kite, '
firmly as a sailor climbs the shrouds, and drag up a heavy
An eagle weighing not over twelve pounds has been known to
height of 10 feet or more, eighty-five pounds.

The following instance is well authenticated, and is taken
School:

"A girl named Elizabeth Moore, daughter of Albert
northeast corner of Cleburne County, Alabama, was returning
bor's house, whither she had been sent on an errand, when
heavy strike her shoulder, and the next instant she was borne to
says that her first impression was that she had been seized by a
other wild beast, but soon felt the talons of what proved to be a

ing her sides and arms, lacerating the flesh in a fearful manner. With its l pecking her on the head she was dragged some distance on the ground. P soon the eagle, having secured its prize, with its claws and bill firmly fixed, r ner from the ground, and sailed along at from three to four feet above the for some distance; occasionally she was dropped on the ground, but the would as often raise her again, making new wounds with its claws in her b its beak in her head. At last it reached the height of ten feet, and attem flight on the limb of a red oak tree by the roadside; here its hold again and she fell to the earth stunned and hurt. She was unconscious for a t clambered over the fence near by her father's orchard, and began ma best of her way to the house, near which she was met by her mother, who attracted by her screams, and was hastening to her relief. The mos part of the matter is that the girl did not see the eagle at all. A sh had been securely fastened about her head, so as to project over the f her rude antagonist from her view. The track along which she had however, was plainly visible in the road, and she distinctly heard of its wings as it clove the air.

The girl, Elizabeth, is fourteen years of age, and weighs between eighty pounds. Her father is a reliable and worthy man, he is son-in-law of in the same section of the county, and lives about five miles from th Iron Works. The girl was not seriously hurt, and is doing well. has been twice seen since by the hunters, who are making every effo capture or kill it. Although this is a somewhat exceptional case, as eagles sel attack human beings, yet instances of their attempts upon small children are no known, but they often attack and carry off pigs of forty to fifty pounds weigl

VENTILATION.

When the method of ventilating buildings by the introduction of fresh a means of pipes was first tried in England, it was believed that it would cove whole ground, and settle the vexed question of ventilation at once; but it soon found that the external air thus brought into rooms in the more densely p lated parts of cities was often filled with little black particles of dust and sm making it not only unpleasant, but unwholesome; and the subsequent applia for screening and winnowing this smoky atmosphere not in anywise answerin desired purpose, a most novel substitute has just been patented, which at pr seems to be a fresh step towards perfection, and is like to supercede all modes of ventilation, as by means of it not only fresh, but purified air can fin way into every room in the house.

A ventilating pipe, which consists of a vertical and a horizontal portion necting with the external air, is so filled up with a water box, or tray, and de

tical pipe, fixed against the inside wall, mig
manner, or hidden behind furniture or curtain
tate. If this way of ventilating should prov
still the return gases from the sewer pipes to t
deadlier foe than these noxious gases that st
But one thing at a time is, perhaps, best. I
provement. and hope for a solution of the re
early day.—*American Builder.*

NEW CALEDONI

Through the explorations of M. Garnier
mineral, consisting of hydrosilicate of nick
destined to acquire considerable industrial im
the midst of abundant masses of serpenti
and in association with euphotides, diorites,
rocks. Sometimes this combination of nick
form of a fine green covering; at others it
intensely; and again it is found in both filir
expected, the nickel is almost invariably
chromium. The metallurgical treatment p
Bouillet is quite simple. The material dissolv
by lime under form of a nearly pure nickel o
gives a metal 99 per cent. fine, incomparabl
sulphuretted and arsenious ores hitherto em
free state that the metal is best used. As con
of 15 per cent. nickel, against 85 of coppe
alloy is produced, excellently suited for all m

DIAMETERS OF THE PLANETS.

The following table gives the latest and most reliable values of the [illegible] of the planets reduced to the earth's mean distance from the [illegible] diameters in English miles. They are found in every case [illegible] which, from observational circumstances, appear to deserve the [illegible] and in the reduction to true values the solar parallax is taken 8".[illegible] diameter of the earth's equator is adopted:

Planets.	*Second..*
Mercury,	6.35
Venus,	16.95
Mars,	9.305
equatorial,	197.47
polar,	184.76
equatorial,	166.82
polar,	148.50
	68.57
	67.26

—*Annual Cyclopedia.*

THE SATELLITES OF URANUS.

From recent careful operations the Satellites of Uranus are found to [illegible] in the same plane, and their orbits are all very nearly circular. Their [illegible] and periods are as follows:

Satellite.	*Rad. of Orbit.*	*P*
Ariel,	13."78	2.52
Umbriel,	19."20	4.14
Titania,	31."48	8.70
Oberon,	42."10	13.4[illegible]

The distances of the Satellites from the center of the primary i[illegible] miles are:

Ariel, [illegible]
Umbriel, [illegible]
Titania, [illegible]
Oberon, [illegible]

The masses of the satellites are only about $\frac{1}{18,000}$ of that of th[illegible] Their mutual perturbations must therefore be feeble.

gion extending at least 400 miles in length and 25
peared to be of a horse-shoe shape, greatly elonga
succeeded by a narrow dark space, with a cone of
to blind the eyes for a moment. It had a flowing
like train.

It exploded, with detonations, so loud and
and to jar the windows like an earthquake.

The products of the explosion of this meteor
tent of country, extending about seven miles long
These fragments weighed from a few ounces to 7
found about 500 pounds in weight. The specific
by Prof. J. Lawrence Smith to be 3.57.

REVIEWS AND LITERAI

Eighth annual report of the noxious, benefici
of Missouri, by Chas. V. Riley, State Entomologi
of more benefit to the horticulturist and agricultu
of the nature and habits of insect life. In these
this branch of knowledge are given to the reade
interesting.

From the author, Prof. G. K. Gilbert, of W
little pamphlet entitled *The Colorado Plateau Re*
of information in a small compass.

We have received the July number of the *Ha*

NOTES.

Very many jelly-fish are so delicate and transparent that a casual
often fails to see them, even in the clear and still water of an aquarium
movement of the animal betrays its existence by presenting its parts in a
ight. A great variety exists in the shape of these animals, and they
uch in size, some being so small as to be almost invisible to the na
hile the cyanea arctica, a sea-blubber, has an umbrella-shaped disk se
across, while the tentacles measure 112 feet. The jelly-fish are short-liv
period of existence is only about twelve months; the eggs laid in the fal
ydroids in the winter, jelly-fish in the spring, and, after having made th
sary arrangements for a continuance of the species, die during the fall
numbers of the jelly-fish are washed by storms upon the beach and perish
hey melt almost literally into jelly, and leave no trace behind them, the
substance being of the most perishable elements, nearly the whole anim
vater. One animal when alive weighed thirty-four pounds, but when
weighed only five and-a-half ounces. Were it not for their delicate structu
animals would be extremely dangerous, for their long tentacles are capable
ducing a severe smarting sensation by mere contact, while their nearly
transparency renders their noiseless approach almost imperceptible. Wh
tentacles become fastened to some body too powerful for them it is immed
dropped off by the fish and left behind, while the animal itself seeks s
flight; but the dead tentacal is as poisonous as when alive. Bathers along
lantic coast often encounter these fish unawares, and receive severe wounds
raise red swellings similar to those produced by nettles. The fish use these t
not only in defense, but to capture and paralyze their prey, which consists o
crustacea, fish, other jelly fish, or polyps. Captured jelly-fish show the rem
a recent meal, their transparency affording the most perfect study of their i
organisms. The tenacles are covered with small cells, lasso cells, as they are
and each cell contains coiled up within itself in a spiral manner a long, s
whip, finer than the finest thread; these are uncoiled and thrown out at th
of the animal, their movements being so quick and instantaneous, and their
ing power so great that they work speedy destruction upon their prey. The
of the jelly-fish are as varied as their form and size; some are white, some b
others red, while some again are variously marked with pink, yellow, orang
and purple; at night many shine with a bright phosphorescent fire, some
resembling globes of brilliant gold, or shed forth resplendent flashes of green
or carmine flames, that seem to kindle the waters with a brilliant and magni
light.

Some jelly-fish resemble an inverted saucer, others a globe or sp
while some resemble pears.

The modern science of medicine has achieved its greatest triumphs in di
ing the immediate sources of many diseases and pointing out the means of a

ing them. To the list of perils that may be avoided by proper
to be added the danger of illness from the use of impure ice.
instance of this on record has been very fully set forth in a
Massachusetts State Board of Health, by Dr. A. H. Nichols,
break of an intestinal disorder among the guests of one of
Beach in the summer of last year. The symptoms were those
a derangement of the digestive system; such as nausea,
diarrhea, abdominal pain, and fever. With about five per
these symptoms were grave and persistent; among the great
with children under ten years old, there was no such illness,
traces of it at the other hotels and in the cottages of Rye
of the hotel was first carefully investigated, and then the
prietors of the hotel lending eager aid to the research; even
processes were overhauled without finding the cause of
discovered in the ice with which the hotel was supplied. This
from a pond of which the outlet had in recent years been
stones washed up from the sea; the pond thus becoming a
mud and sawdust, there being two saw-mills on the stream
subjected to chemical analysis, and was found to contain
matter. The hotel stopped using this contaminated ice, and
the sickness among its boarders. The report concludes by
is a common but quite mistaken popular notion that when
ties are somehow excluded from the ice. The mortal is so
here be stated; but in a general way it may be worth while to
that water which is not perfectly fit to drink is unsuitable
—*Tribune.*

The climbing perch is a spinny-finned fish (*acanthopterygi*
tries, during the dry season, it often happens that many
dried up by the excessive heat. The respiratory organs of
Anabas have therefore been constructed so as to enable them
the water for a considerable space of time, and by these means
migrate in search of their natural element. Naturalists tell
small receptacles in which they are able to preserve the
which they moisten their gills. The most celebrated of these
the climbing perch (*Anabas scandens*). Mr. E. Layard, the
in the ruins of Nineveh and Babylon, once encountered
traveling along a hot, dusty road, in the midday sun, and
gist of reputation, asserts that he has seen this species in
palm trees, and effecting its ascent by means of gills and tail,
spinous gill-covers. Other naturalists have also mentioned the
up the banks and living out of the water. Sir Robert
certain species of Dora, in Guiana, have the same habit, and
met with in such numbers on their terrestrial travels that the

with them. These fishes, provincially called Hassars, man can walk, the strong scaly bands which envelop tating their progress over the ground. If they fail in burrow in the still soft mud, and pass the dry season *Home and School.*

Almost all phases of physical force generate motion of glass with silk, thus throwing it into a state of elec that bits of paper or thread fly towards it, and are, in again. We hold the bulb of a thermometer in our expands in bulk, and, rising along the scale, indicates received. We heat water, and its particles are immed expanded and heated bubbles rising and the cooler partic ing a system of circulation through the liquid. We bri number of iron filings, and they move toward it, arrang liar and intricate lines; or we bring a piece of iron near we find it turned away from its ordinary position. If w from a mass of matter, it falls, through the influence of pieces of paper upon a stretched string, and then sound a we find certain of the papers projected from their places. "sensative flames," which are violently agitated by certa become well-known as instances of the conversion of sound ical action is also a proficient factor in the production of many respects the greatest of the powers of nature, has capable of producing motion. Cold or the absence of heat in the particles of a body perhaps as well marked as heat. A

An opportunity is at hand for valuable service to astrono On the morning of August 18, a conjunction of Venus wit Geminorum will take place, and if careful micrometric obser rence are made in northern and southern latitudes, they will ascertaining the sun's distance little inferior in accuracy to the vations of the transit of venus. The question will be natura unfamiliar with astronomical methods—How is it possible to distance from such observations on the position of Venus? The follows: Kepler's third law states that the squares of the peri planets are proportioned to one another as the cubes of their me the sun. As we know the exact periodic times of the earth and orbits, we have therefore the exact proportion of their mean dis sun. In round numbers the distance of Venus from the sun is of the earth's distance from the sun. The proposed observations to measure more accurately the four fifteenths between us and V is a matter of proportion and calculation, in which figures with

places have to be used, a
planets. It is hoped that t
clear, by those who have
Geminorum is a fourth mag

It is a well attested fact
tities of the dreaded Colora
up the ground to procure th
reason alone, if there were
tected and encouraged to v
kind in numerous other wa
insects which, if left to inc
orchard, garden and fiel
Catcher, (*Vireo Olivaceus*),
Yellow-Billed Cuckoo, (
Great Creasted Fly-Catch
(*Quiscalus Versicolor*), besid
and destroy vast numbers.
will appreciate the inestim
them around their homes.
stroyed the earth would s
and grubs would so increa
tation from the face of the

GUANINE.—The perf
alburnus), a fish indigeno
manufacture of artificial
lubricates the scales of th
and is obtained by careful
water. Care is taken not
low, while the white scale
horse-hair sieve. The first
scales are then washed and
to the bottom of the tub, a
takes 40,000 fish to furnish
tin boxes with ammonia, an
essence be taken up by a st
most brilliant colors. Mere
stance, imitate the real gem

FLOWER COLORS.—The
One would hardly think that
ever be utilized in commerce,

out that they may be put to some other purpose than that of
and refreshing the nose. They yield, it appears, a very fine
is so sensitive to exterior influences as to render it of consid
analytical chemist. Most people know that one of the best
tests employed by chemists to ascertain whether a solution is ac
into it a piece of blue litmus paper, which at once reddens if
acidity exists. In like manner the reddened litmus paper may
searching for alhalics, for the paper returns to a blue tint on
with them. The coloring principal of the violet and iris is found
cate still than litmus, and for this reason we may expect soon to
—for so the new color is called—introduced into all our laborator

---

AMONG the minerals sent by the Dominion Government to
Exhibition is a fossil plant from the coal measures, the tissues of
up with galena, a lead ore. Galena was also found in a small ve
a layer of sandstone, between two coal-beds. Mr. Poole, the G
spector, says: Whether new or not, such specimens are of
confirming the theory of the aqueous origin of some mineral veins
the blast furnace has proved that galena can be volatilized by heat,
lized on cooling. The finding of galena in places where it could not
been exposed to a high temperature requires some other agent th
count for its aggregation and deposition, and suggests the universa
solution—water, as the agent." This is true, but these specimens
deposition from aqueous solution to be the sole method of vein origin.

The "Pearl-Shell" Fishery of Western Australia is becoming a
ant trade on the Australian Northwest coast between the 15th and 2
of south latitude. Less than seven years ago this trade did not exist.
the last three years it has gone on increasing in importance, till last ye
of shells were exported to London, and 67 tons to Singapore, chiefly f
sion thence to the same destination. The price now get per ton is fro
£280. The trade is chiefly carried on by a few squatters resident on
western coast, or by small capitalists, who proceed in the proper seaso
crafts of from forty to eighty tons to the coast where the shells are
there engage Malay, Japanese, or Australian natives as divers, at almos
wages. Last season was a prosperous one, and the trade promises to h
great importance.—*English Paper.*

EXPERIMENTS ON THE FADING OF COLORS.—It has been obse
Koechlin that woolen cloth dyed with indigo had its peculiar blue colo
diminished by being exposed to a freezing temperature. According to
periments made by Goppelsrader, this discolorization is due to ozone
which acts at temperatures below zero, but only when the tissue w

Radiata are entirely aquatic, and nearly all of them marine. T
ten thousand species of radiata. These animals are of a low
of creation, and are distinguished by having the several parts
like the spokes of a wheel from a point in the center of the
The Radiata are divided into three classes, namely. 1.
the Corals, etc. 2. Acalephs, including the Medusæ. Jel
Man-of-War, etc. 3. Echinoderms. including the Sea C
Crinoids, etc.

Bretschschneider, physician to the Russian Embassy at
an interesting mountain, the Pei-hwa-shan, or Mountain
three or four days journey from Pekin. This mountain
it rises to the height of 8,000 feet. and is covered with
flora; its summit is a plateau 8,000 paces by 200. upon
dedicated to the mountain god. Although it was in
collected fifty blossoming plants. among which
Encyclopedia.

NOTICE TO THE SUBSCRIBERS TO THE SCIENTIFIC MONTHLY.

With this number we have completed the first year and first
SCIENTIFIC MONTHLY. Commencing our enterprise at a time
country was laboring under a financial depression, we can
reception our project has received, not only throughout our
Europe. Thanking our numerous subscribers and contributors,
continue in the future to aid us by their good wishes, and
help of their subscriptions.

Those who desire to have the first volume bound, will
numbers to our office. and we will have them neatly and
in morocco backs and corners, gilt title page, etc., for $1.50 per

EDITOR SCIENTIFIC

Cochineal reds on wool seem to lose their brilliancy when exposed to of ozone for eight days. Analine black was unchanged, but analine tons was turned into a yellowish brown. Magenta, analine blues, and v iodine greens were unchanged, as were lakes, and strong colors, as T Ozone seems, however, to have in some instances the property of devel intensifying certain colors, more especially the analine blacks.—*Manuf Builder.*

THE total production of some of the principal mining products in States since 1876, so far as known, is as follows:

Anthracite Coal, tons,	3
Pig Iron, tons,	
Lead, tons,	
Copper, tons,	
Quicksilver, (flasks of 76½ lbs.)	
Gold, dollars,	1,3
Silver, dollars,	2
Petroleum, barrels, (42 gallons each)	7

The above tons are all of 2,240 pounds each. Of quicksilver 28,700 tons; gold, 2,000 tons; silver, 6,250 tons; and petroleum, tons taken out.—*Galaxy.*

THE Russians, in a reconnoissance of newly occupied territory in have come upon the half-buried ruins of an ancient Mohammedan city. and remains of distinctly Saracenic architecture are found preserved. are on a steppe east of the Caspian Sea, which, after a tradition of mans, was once extremely fertile, and irrigated by a canal conduct Atrek. The ruins are of great extent, and indicate a numerous and lation. The remains of large tanks and water-pipes were discovered. tions found are in decipherable characters, and are sent to St. terpretation.—*Ann. Encyclopedia.*

POTATO-BUG SAILORS.—The sea-coast in the vicinity of this shores of Long Island Sound are, at the present time, undergoing countless myriads of potato bugs. They seem to cling to the floating and are left therewith on shore by the tide. At Coney Island, and directly on the ocean, the bugs are most numerous, showing that they brought hither by sea currents, and by similar means have been swept Island Sound. It seems hardly possible that the insects will now fail to other side of the Atlantic, as they may find transportation on vessels, ried over in the drifting weed of the Gulf stream.—*Exchange.*

Radiata are entirely aquatic, and nearly all of them marine. least ten thousand species of radiata. These animals are of a low scale of creation, and are distinguished by having the several parts radiate like the spokes of a wheel from a point in the center of the c extremities. The Radiata are divided into three classes, namely. 1 cluding the Corals, etc. 2. Acalephs, including the Medusæ, Jelly guese, Man-of-War, etc. 3. Echinoderms, including the Sea Cucu Fish, Crinoids, etc.

Dr. Bretschschneider, physician to the Russian Embassy at Pel visited an interesting mountain, the Pei-hwa-shan, or Mountain of Flowers, three or four days journey from Pekin. This mountain is n any map; it rises to the height of 8,000 feet, and is covered with an brilliant flora; its summit is a plateau 8,000 paces by 200, upon whic monastery, dedicated to the mountain god. Although it was in the s Bretschschneider collected fifty blossoming plants, among which were species.—*Ann. Encyclopedia.*

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With this number we have completed the first year and initial volume SCIENTIFIC MONTHLY. Commencing our enterprise at a time when the was laboring under a financial depression, we can but be please the reception our project has received, not only throughout our own land, Europe. Thanking our numerous subscribers and contributors, we hop continue in the future to aid us by their good wishes, and also by the su ial help of their subscriptions.

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EDITOR SCIENTIFIC MONTHL

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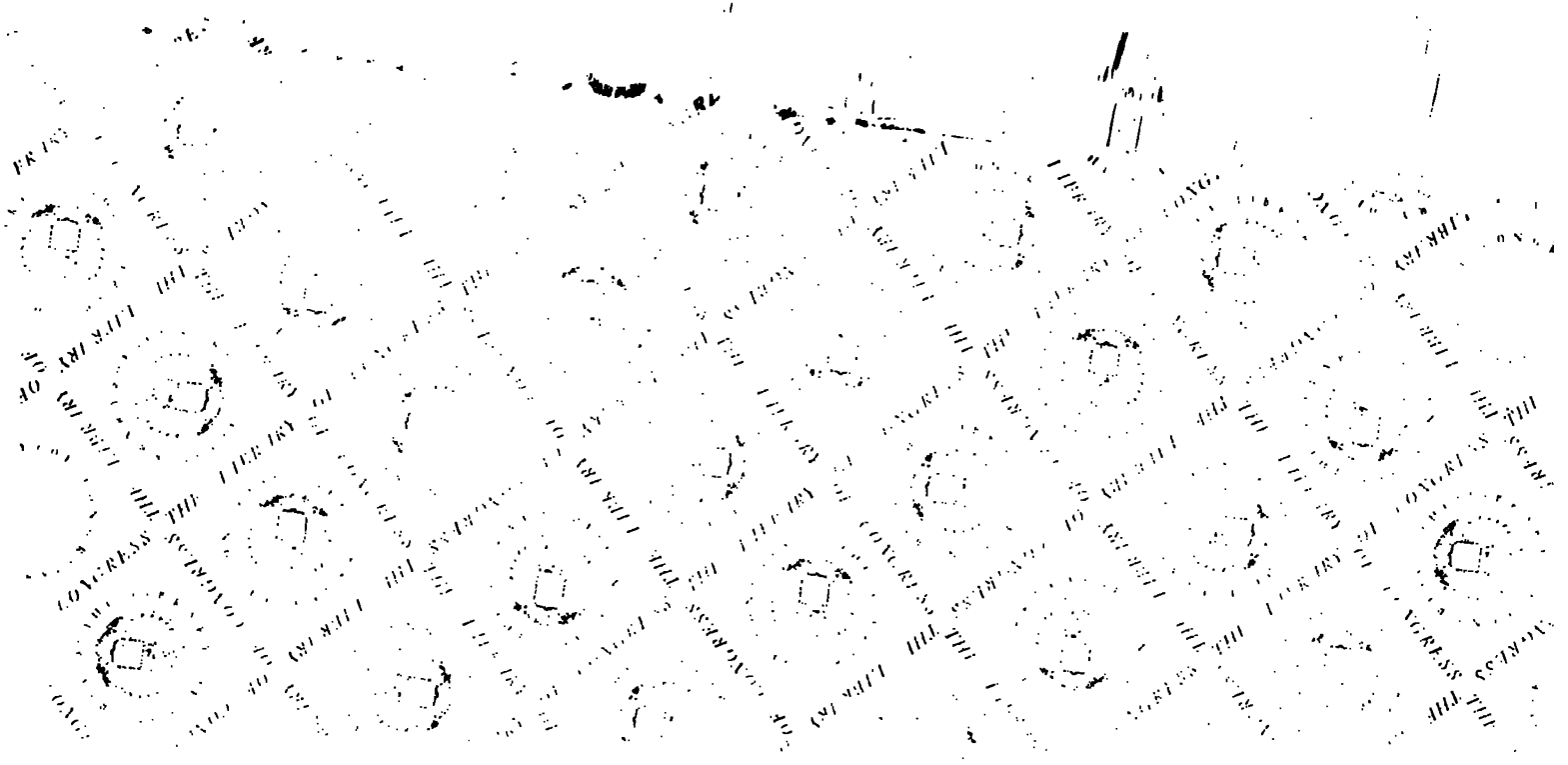
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